

ANALYSIS OF USER REQUIREMENTS  
FOR SMALL-SCALE SYSTEMS

INPUT

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# INPUT

Planning Services for Management

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FOR SMALL-SCALE SYSTEMS

AUGUST 1983



**ANALYSIS OF USER REQUIREMENTS FOR  
SMALL-SCALE SYSTEMS**

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## I INTRODUCTION



## I INTRODUCTION

- This report is produced by INPUT as part of the U.S. 1983 Field Service Program and is for clients of that program.
- The purpose of this report is to provide INPUT's clients with knowledge of current small-systems user requirements and insight into the levels of user satisfaction with maintenance services. Both are provided as input to the decision-making process of key field service executives.
- New issues, such as using field engineers in a sales role and customer involvement in the maintenance process, are critically reviewed from the perspective of the user.
- Each of the four user requirements reports concentrates on one area of the market. This report is specific to small-system users. The top 14 small-system vendors are treated separately so that they each may review their data against the norm.

### A. DEMOGRAPHICS

- Three hundred forty-two users responded to the survey. The majority of respondents were managers, as shown in Exhibit I-1.

EXHIBIT I-1

TITLES OF RESPONDENT USERS

TITLE	NUMBER OF RESPONDENTS
Presidents	5
Vice-Presidents	2
Controller/Treasurer	8
Directors	13
Department Chief	3
Manager	225
Supervisor	60
Analyst	26

- Users of 13 small-system vendors were represented in the sample, as shown in Exhibit I-2.
- Discrete manufacturing companies dominate the list of users of small systems, as shown in Exhibit I-3.
- Ten percent of the small-system users surveyed indicated gross sales of over \$10 billion.
  - Twenty-two percent of the users sold between \$1 million and \$1 billion.
  - The remainder of the small-system users sold \$1 million or less in goods and services.
- Thirty percent of the respondent users employ 1,000 or more employees.
- The applications that small-system users considered the most critical are displayed in Exhibit I-4.

## B. METHODOLOGY

- The basis for the interviews was the questionnaire shown in Appendix A.
  - The data obtained was captured on the dBase II<sup>T.M.</sup> relational data base management system, and analyzed using ABSTAT<sup>T.M.</sup>.
  - The outputs were summarized to produce the exhibits that are a part of this report.
- As with all reports, the data selections are representative. Clients receive a copy of the raw data both on a printout and on floppy disk. This arrangement

EXHIBIT I-2

VENDORS REPRESENTED IN USER SURVEY

VENDORS	NUMBER REPRESENTED
Autotrol	21
Burroughs	30
Computervision	19
DEC (Digital Equipment)	31
Data General	30
Datapoint	20
Four Phase	20
Hewlett-Packard	20
Honeywell	30
IBM	40
Intergraph	20
NCR	21
Prime	20
Texas Instruments	20

### EXHIBIT I-3

#### INDUSTRY SECTORS SURVEYED

INDUSTRY SECTORS	SECTORS SURVEYED
Banking	13
Discrete Manufacturing	109
Education	11
Government-Federal	4
Government-State and Local	38
Insurance	9
Medical	8
Process Manufacturing	27
Retail	22
Services	31
Services EDP	5
Transportation	13
Utilities	12
Wholesale	36
Other	4

## EXHIBIT I-4

MOST CRITICAL APPLICATIONS, AS  
RANKED BY USERS

APPLICATION	TIMES RANKED # 1	AVERAGE RATING WHEN RANKED #1 (1-10)
Order Entry/Accounts Receivable	55	9.6
Engineering Design/CAD	41	8.9
Payroll	39	9.3
Materials/Inventory Control	33	9.5
General Ledger Accounting	20	9.1
Time Sharing/TP Network	15	8.9
Invoicing	12	9.9
Process Control/CAM	12	9.5
All Others	115	9.2
<b>Total</b>	<b>342</b>	<b>9.3</b>

allows them to perform extended analysis according to their own requirements.

- The data base file formats are contained in Appendix B.
- Client comments on the usefulness of these data structures are solicited.
- The survey results have been combined with ongoing research at INPUT to prepare this final report on users requirements.



## II EXECUTIVE SUMMARY



## II EXECUTIVE SUMMARY

### A. TOTAL SERVICE CONCEPT

- The total service concept embraced by the more successful vendor organizations extends far beyond reacting to reported machine failures and recognizes the dynamics of user requirements.
  - Changing user requirements in the after-sales support area create opportunities in field service for innovative vendors and result in increased revenue opportunities.
  - This total service concept is emphasized in this report on user requirements.
- Although some service organizations in the small-systems sector have combined software and hardware maintenance, the users' response to the level of service varies significantly.
  - Hardware maintenance achieved a higher rating than software maintenance.
  - Among vendors the ratings for hardware maintenance are also much more consistent than the ratings for software maintenance.

- Organizational differences are the most likely cause: There is a broad disparity in ratings among vendors (such as IBM) as to whether they have software support personnel reporting to field service.
- Before instituting new service methods, careful planning for total support of the customer base must be accomplished. This is borne out by the responses throughout the user survey.
  - Traditional on-site maintenance is favored by all users, thus pointing out the value of personal contact.
  - The ability to communicate with the vendor dissipates as new methods are implemented: old contact channels are lost, people are shuffled around the service organization, and new interfaces are introduced.
  - Remote support, mail-in repair, and support centers leave the user responsible for final problem determination. This affects the users' productivity, and requires them to build a high level of expertise within their own organizations.
  - Future sales of new equipment and the upgrading of existing equipment could be significantly affected by these losses in communications.
- Since the small-systems user has needs similar to those found in the large-system sector, the future is somewhat predictable.
  - The field service engineer will be used in a large variety of roles in the coming two years. This arrangement will result in losses of FEs from some organizations and in opportunities for the remaining ones.
  - In the large-system sector field engineers carry out the account-management functions. The FE provides the user with an individual from

the vendor's organization to whom the user may communicate ideas and problems.

- This new role has been steadily increasing and has had a positive effect on sales opportunities.
- Handling all the users' service needs is a natural growth path for field engineering.

## B. AFTER-SALES SUPPORT

- The small-system vendor must also provide the user with satisfactory after-sales support. The vehicle could be the field service organization. As hardware becomes easier to maintain, field service expertise can be used in software support and in various sales roles.
- Some of the services that are defined as after-sales support and which users indicate require more vendor attention are:
  - Taking the initiative to improve user operations.
  - Software response time and communication.
  - Documentation.
  - Supply sales.
  - De-installation.
  - Relocation.

- The above services could be handled by field engineering, although there was significant user resistance to field engineers who sell both supplies and software packages. In all other areas the users seemed generally favorable to dealing with field engineering.
- Services which are considered to be after-sales support components are:
  - Environmental planning.
  - Physical site planning.
  - Systems consulting.
  - Documentation.
  - Training.
  - Installation planning.
  - Hardware maintenance.
  - Software maintenance.
  - Supplies sales.
  - Add-on sales.
  - Site audits.
  - Relocation.
  - De-installation.

- Since field service organizations spend the most time at user sites, several of the above services could be their responsibility.
- Environmental planning, physical site planning, and installation planning are technical areas normally handled by field service.
- Systems consulting, software maintenance, add-on sales, and training are generally handled by market support.
- Documentation responsibility is generally split into several departments. Field service is normally responsible only for maintenance documentation.
- Supply sales and future upgrades are primarily handled by sales organizations.
- Site audits, relocation, and de-installation are handled by field service.
- Increased productivity and improved user relations could result from combining several of the after-sales support services.
- As the industry continues to grow and new technologies evolve, system maintenance and account responsibilities will become even more important.
  - Field service is generally organized by territory, with assigned account responsibilities.
  - With an aggressive training program in software support for field engineers, hardware and software maintenance could be combined. This would allow software analysts to concentrate their efforts on sales teams and in closing new accounts.
  - In this increased role, field service should improve sales of upgrades and add-ons.

- Account knowledge would also assist in correcting the communication problems expressed by several users.
- Users generally like dealing with field engineers who have a sales role. Only with respect to supplies sales and software packages was there significant resistance to this idea.
  - In order to properly support the user with supplies, a salesperson committed to that function must be assigned. Users cannot wait for supplies; in most cases they need immediate response.
  - Software packages may or may not be available through the vendor.
    - Field service should only be responsible for informing the user about the availability of software.
    - There may be a feeling on the users' part that software sales could interfere with the field engineers' availability, or that it could place engineers in a role where profitability is more important than service.
- Regardless of the users' feelings at this time, the fact remains that hardware maintenance will become less difficult. Thus, from the point of view of both vendor and user, the field engineer is the perfect candidate to provide total after-sales support.

### C. REQUIREMENTS VERSUS CURRENT SERVICE

- Measured in the aggregate, users rated service received as lower than required, but vendor and user priorities are basically in agreement.

- Areas requiring industry-wide attention are software maintenance, documentation, supplies sales, relocation, and de-installation.
- In this chapter, discussion will be limited to the overall ratings of all vendors. Individual vendor's results will be discussed in later chapters.
- Users rated software engineer communications, ability to maintain software, and software response lower than that for hardware.
  - The ability to maintain software is on the whole more complete than it is with hardware, but communications and responsiveness in the software area are basically the same.
    - Software support has a shortage of qualified people.
    - Most software engineers would rather develop programs than repair them.
- Documentation remains a problem.
  - In most cases the documentation effort receives lowest priority and is started quite late in product development.
  - The result of this low priority is late delivery of documents, which are usually of low quality.
  - Documentation is normally written to the level of technical people. Many users of small systems require a more basic type of information. Writers should strive to create manuals that meet the level of their audience.
  - Some vendors have, with positive results, merged engineering, user, and sales documentation groups. A freer exchange of internal information

and a better understanding of users have resulted in significant improvement in documents.

- Users indicated that vendors could give slightly more attention to relocation and discontinuance services, but stopped short of severe criticism in this area.
- Supply sales are clear opportunities for additional revenue. Vendors should consider committing salespeople to this function.
- Users perceive that pre-installation activities are being performed up to their required level.
  - Pre-installation services were rated lower in priority than most items.
  - The problems associated with installation planning are more noticeable when two or more vendors must be coordinated.
  - Poor documentation is most noticeable during pre-installation planning.

#### D. USER RATINGS OF VENDORS

- The overall service image of vendors was generally rated high. Vendors averaged 7.54 (mean) on a scale of 1-10, as shown in Exhibit II-1.
  - There was a significant correlation between vendors that scored low on questions of responsiveness and those that scored low on overall service image.
  - User response to the above two issues tends to reflect the user's view of the vendor's attitude.

**EXHIBIT II-1**  
**USER RATINGS OF**  
**OVERALL SERVICE IMAGE**

VENDORS	RATINGS (1-10)				NUMBER OF RESPONSES
	MEAN	STANDARD DEVIATION	MEDIAN	MODE	
All Vendors	7.54	1.78	8.0	8.0	342
Autotrol	6.19	1.33	6.0	7.0	21
Burroughs	6.77	2.16	7.0	8.0	30
Computervision	7.32	1.77	7.0	7.0	19
DEC	8.03	1.82	8.0	8.0	31
Data General	8.03	1.10	8.0	8.0	30
Datapoint	7.65	2.08	8.0	8.0	20
Four Phase	7.40	2.33	8.0	5.0	20
Hewlett-Packard	7.70	1.42	8.0	7.0	20
Honeywell	7.40	1.71	8.0	8.0	30
IBM	8.25	1.35	8.5	9.0	40
Intergraph	7.15	1.76	8.0	8.0	20
NCR	7.57	1.47	8.0	8.0	21
Prime	8.05	1.32	8.0	8.0	20
Texas Instruments	7.35	2.28	8.0	8.0	20

- Vendors are always looking for future products to increase user productivity, and thus they should be less than satisfied with their users' view of vendor initiative in improving user operations. Service vendors are not adequately protecting the installed base.
- In the hardware sections of the survey, users rated field engineering higher. This rapport with the user community could be effective in assisting vendors with several problem areas.
- Some key user ratings follow.
  - In all cases the mean score is skewed by vendors that are significantly above or below the average.
  - Overall survey results should be studied prior to drawing any conclusions.
  - Exhibits II-1 through II-4 show users' views on overall technical abilities and service images.

**EXHIBIT II-2**  
**USER RATINGS OF**  
**THE ABILITY TO DIAGNOSE PROBLEMS IN**  
**HARDWARE AND MAKE QUALITY REPAIRS**

VENDORS	RATINGS (1-10)				NUMBER OF RESPONSES
	MEAN	STANDARD DEVIATION	MEDIAN	MODE	
All Vendors	7.60	1.68	8.0	8.0	339
Autotrol	6.81	1.36	7.0	7.0	21
Burroughs	7.10	2.23	8.0	8.0	30
Computervision	7.32	1.92	8.0	9.0	19
DEC	7.87	1.65	8.0	8.0	31
Data General	8.10	1.09	8.0	9.0	30
Datapoint	7.45	1.99	8.0	8.0	20
Four Phase	7.60	2.62	9.0	10.0	20
Hewlett-Packard	7.37	1.01	7.0	7.0	19
Honeywell	7.67	1.15	8.0	8.0	30
IBM	8.21	1.42	8.0	8.0	39
Intergraph	7.45	1.47	7.5	7.0	20
NCR	7.43	1.72	8.0	5.0	21
Prime	7.55	1.54	8.0	8.0	20
Texas Instruments	7.84	1.68	8.0	9.0	19

EXHIBIT II-3

USER RATINGS OF THE  
ABILITY TO MAINTAIN SOFTWARE

VENDORS	RATINGS (1-10)				NUMBER OF RESPONSES
	MEAN	STANDARD DEVIATION	MEDIAN	MODE	
All Vendors	6.79	2.07	7.0	8.0	251
Autotrol	5.00	1.84	5.0	5.0	21
Burroughs	6.55	2.21	7.0	7.0	20
Computervision	6.21	2.04	6.0	5.0	19
DEC	7.30	2.22	8.0	8.0	20
Data General	8.56	0.88	9.0	9.0	9
Datapoint	7.27	1.96	8.0	8.0	15
Four Phase	6.65	2.40	7.0	9.0	17
Hewlett-Packard	7.05	1.75	7.0	6.0	19
Honeywell	6.50	2.04	7.0	7.0	24
IBM	7.79	1.50	8.0	7.0	29
Intergraph	6.22	1.99	6.5	8.0	18
NCR	6.27	2.46	7.0	7.0	15
Prime	7.27	1.58	7.0	7.0	15
Texas Instruments	7.40	1.78	8.0	8.0	10

EXHIBIT II-4

USER RATINGS OF  
SYSTEM REPAIR TIME

VENDORS	RATINGS (1-10)				NUMBER OF RESPONSES
	MEAN	STANDARD DEVIATION	MEDIAN	MODE	
All Vendors	5.82	10.85	2.0	2.0	332
Autotrol	24.38	18.31	24.0	24.0	21
Burroughs	3.69	4.46	2.0	2.0	30
Computervision	7.45	11.09	4.0	2.0	19
DEC	2.35	1.62	2.0	2.0	31
Data General	2.57	2.37	2.0	1.0	29
Datapoint	2.89	5.24	1.5	2.0	20
Four Phase	5.35	15.72	1.8	1.0	20
Hewlett-Packard	3.28	2.38	2.2	1.0	18
Honeywell	2.03	1.11	2.0	1.0	29
IBM	3.62	5.19	2.0	1.0	40
Intergraph	12.08	14.30	8.0	8.0	20
NCR	3.91	3.18	2.5	2.0	17
Prime	3.92	5.35	2.3	1.0	18
Texas Instruments	10.65	20.40	2.0	2.0	20



### III AFTER-SALES SUPPORT REQUIREMENTS



### III AFTER-SALES SUPPORT REQUIREMENTS

#### A. OVERALL USER ANALYSIS

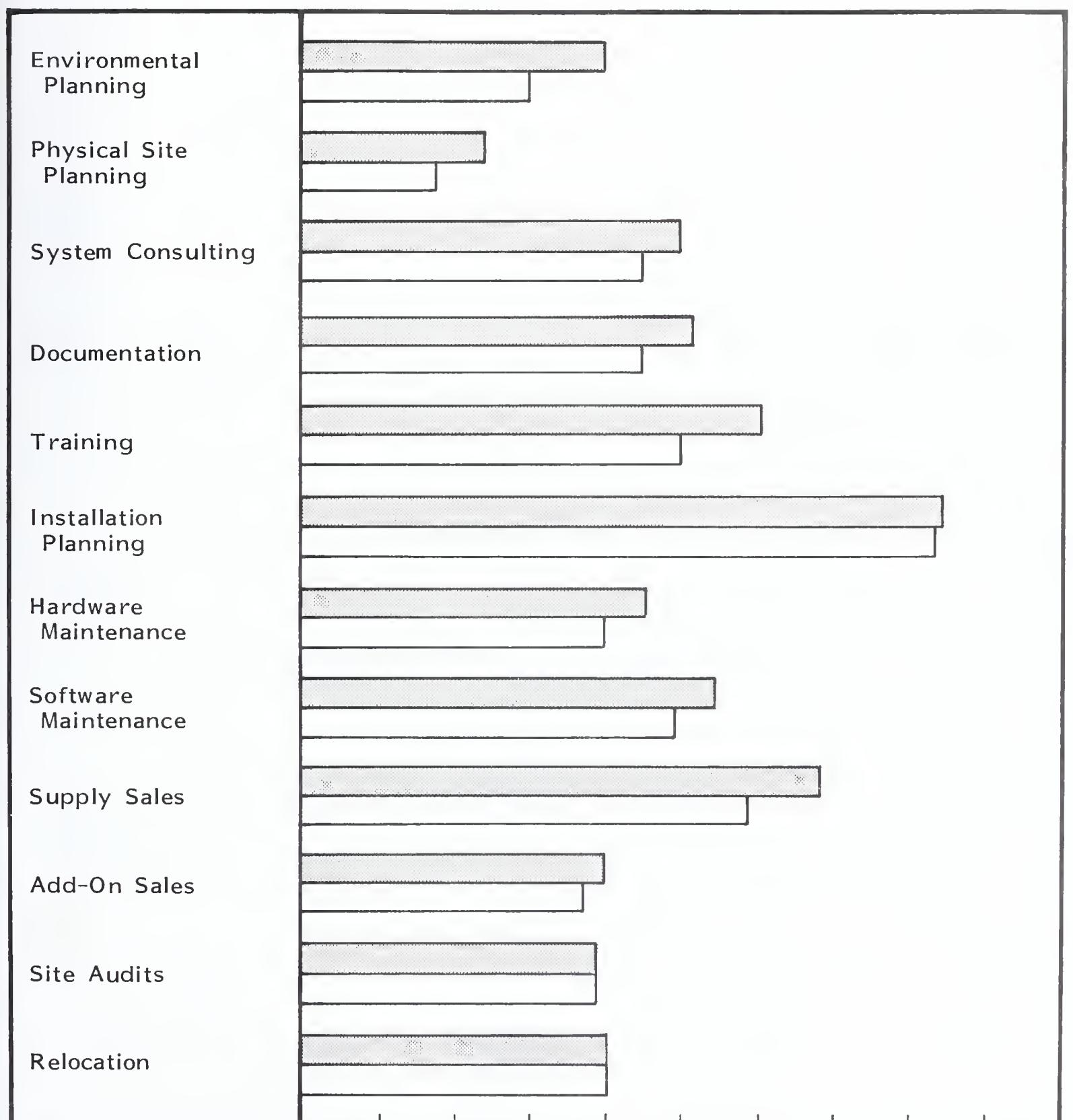
- The user priority ranking of after-sales services closely matches the vendors' delivery priority, as shown in Exhibit III-1.
- Exhibits III-2 and III-3 compare requirements to actual services received. In almost every service, users rate vendors as being below the required level.
- The greatest disparity is in software support. Few vendors provide the level of support required by users. This is a problem that could be improved by making better use of the rapport that field engineers have developed with users.
- Another key area is documentation, where IBM is the only vendor that matches the users' required level of service. When one considers the impact of poor documentation on the ability of users to operate equipment, one understands the relative marketplace strength of the various vendors. Also, users' misuse or misunderstanding of equipment creates many service demands that otherwise would not exist.
- After-sales support is the key to future sales. If customers cannot comfortably use the product, they rebel against it. If service is not responsive or is inadequate, the product marketplace potential is never reached.

## EXHIBIT III-1

## AFTER-SALES SUPPORT REQUIREMENTS

SERVICE	PRIORITY OF SERVICE	
	USER RANKING	VENDOR SERVICE QUALITY RANKING
Hardware Maintenance	1	1
Documentation	2	2
Software Maintenance	3	4
Training	4	3
Supplies Sales	5	5
Add-On Sales	6	6
Installation Planning	7	10
Consulting	8	9
Environmental Planning	9	7
Physical Site Planning	10	8
Relocation	11	11
De-Installation	12	12
Site Audits	13	13

**EXHIBIT III-2**  
**USER REQUIREMENTS VERSUS**  
**SERVICES RECEIVED - ALL VENDORS**



Required

Actual

(Rating Scale = 1-10)

## EXHIBIT III-3

**USER REQUIREMENTS FOR SERVICES,  
VERSUS LEVEL OF SERVICES PROVIDED  
(INDUSTRY NORMS)**

TYPE OF SERVICE PROVIDED	AVERAGE LEVEL OF SERVICE*		PERCENT OF USERS REQUIRING		
	REQUIRED	RECEIVED	Less than the Average Level of Service Provided (OVERKILL)	Equal or Greater than Average Level of Service and Get It (SATISFIED)	Equal or Greater than Average Level of Service and Receive Less (DISSATISFIED)
Environmental Planning	4.1	4.1	50.9%	31.0%	18.1%
Physical Site Planning	4.0	4.0	51.8	31.8	16.4
Consulting	4.1	3.9	47.7	30.7	21.6
Documentation	6.8	5.8	35.7	19.0	45.3
Training	5.4	4.9	47.1	21.6	31.3
Installation Planning	4.4	3.9	49.4	29.8	20.8
Hardware Maintenance	8.4	7.9	43.6	21.9	34.5
Software Maintenance	6.1	4.8	43.0	13.7	43.3
Supplies Sales	5.1	4.6	48.2	15.0	36.8
Add-on Sales	5.0	4.6	33.6	39.8	26.6
Site Audits	2.9	1.8	55.8	24.3	19.9
Relocation	4.0	3.1	51.2	28.7	20.1
De-Installation	4.0	3.0	49.1	29.2	21.7

\*Rating: 1 = Low, 10 = High



Areas requiring attention

- User needs in the small-systems sector are different from those in the large-systems group.
  - Because of user expertise, small systems that are installed in the large-system customer base require less support.
  - In the typical small-business environment the resources of the internal user are limited. Thus, training, documentation, consultant services, and overall support are the keys to success.
- In the charts that follow, overkill (or the provision, by a vendor, of a level of service that is higher than the user needs) is highlighted as an area requiring attention if 50% or more users rate the service that way. This is because overkill wastes precious resources and money. Dissatisfied ratings above 40% are highlighted for obvious reasons. The perfect 0% score is undesirable (real overkill); the target ratings ought to be overkill 20%, satisfied 60%, and dissatisfied 20%.

## B. VENDOR ANALYSIS

- The following analysis is supported by a series of exhibits that were constructed using the following statistics:
  - The average service required, based on a rating of 1 to 10.
  - The average service received, based on a rating of 1 to 10.
  - A cross-tabulation of user requirements versus service received, resulting in:

- The percentage of users in an overkill position or requiring less than the average service that was received.
- The percentage of users satisfied, or receiving service that was equal to or greater than that required.
- The percentage of dissatisfied users, or those receiving less than the required service.

## I. AUTOTROL

- The users interviewed were all AD/380 system users.
- Autotrol's overall service picture shows some significant problem areas.
  - Documentation is rated as poor by the majority of users.
  - Hardware maintenance is criticized as being below requirements by over 70% of the users interviewed.
  - Dissatisfaction with software maintenance is almost as high - over 60%.
  - User training is below par, with over 40% of users signalling dissatisfaction.
- Other, less important areas of dissatisfaction include equipment relocation and deinstallation. Exhibit III-4 provides the detailed analysis.
- Autotrol's main areas of strength, according to the users surveyed, are:
  - Environmental planning.
  - Physical site planning.

## EXHIBIT III-4

AUTOTROL USER REQUIREMENTS FOR SERVICES,  
VERSUS LEVEL OF SERVICES PROVIDED

TYPE OF SERVICE PROVIDED	AVERAGE LEVEL OF SERVICE*		PERCENT OF USERS REQUIRING		
	REQUIRED	RECEIVED	Less than the Average Level of Service Provided (OVERKILL)	Equal or Greater than Average Level of Service and Get It (SATISFIED)	Equal or Greater than Average Level of Service and Receive Less (DISSATISFIED)
Environmental Planning	3.9	3.0	57.1%	23.9%	19.0%
Physical Site Planning	3.9	3.4	52.3	28.7	19.0
Consulting	4.5	4.5	57.1	19.1	23.8
Documentation	7.2	5.0	28.6	19.0	52.4
Training	6.8	5.9	38.1	19.0	42.9
Installation Planning	4.7	3.9	33.3	38.2	28.5
Hardware Maintenance	9.0	7.1	23.8	4.8	71.4
Software Maintenance	8.4	5.7	38.1	0.0	61.9
Supplies Sales	3.3	2.7	52.3	33.4	14.3
Add-on Sales	5.4	4.7	23.8	42.9	33.3
Site Audits	3.2	2.1	47.6	28.6	23.8
Relocation	5.2	2.7	38.1	14.3	47.6
De-Installation	4.9	1.0	42.8	4.8	52.4

\*Rating: 1 = Low, 10 = High

Areas requiring attention

- Consulting.
- Installation planning.
- Supplies sales.
- Site audits.
- These are important service requirements and usually contribute to good product reliability and high user satisfaction. The problem may lie in product quality (hardware and software) rather than with the service organization.

## 2. BURROUGHS

- The Burroughs users sample was composed of B800, B900, and B-93 systems.
- Burroughs' performance in satisfying users post-sales service requirements is much better in small systems than in the large-system area (compare Exhibit III-5 of this report with Exhibit III-2 of INPUT's report, Large-Scale System User Requirements, August 1983).
- The principal areas of dissatisfaction are:
  - Documentation (a majority of users are dissatisfied with the quality of Burroughs' support in this area).
  - Hardware maintenance, with over 45% of users wanting a higher level of service than that provided.
- Other areas of lesser dissatisfaction, but still requiring attention, include:
  - Environmental planning (where some users receive far more service than they need and stress less than they need).

- Software maintenance (with a similar picture).
- Overall, the Burroughs small-system service receives high marks and measures up well to the industry average. Exhibit III-5 provides the detail.

3. COMPUTERVISION

- The Computervision sample was entirely composed of users of the Designer system.
- The users' rating of Computervision service was mixed.
  - Excellent ratings of environmental planning, physical site planning, installation planning, and site audits (less than 15% dissatisfied).
  - Average ratings of user training, hardware maintenance, and add-on sales (30%-40% dissatisfied).
  - Very poor ratings of documentation, software maintenance, supplies, sales, and deinstallation (more than 55% dissatisfied).
- The key areas of hardware and software maintenance are not rated highly and require immediate attention. It appears that in both areas Computervision is servicing two very different groups of users, one-third of which are more than satisfied and another half of which are dissatisfied with the average level of service provided.
- Exhibit III-6 provides the analysis.

## EXHIBIT III-5

BURROUGHS USER REQUIREMENTS FOR SERVICES,  
VERSUS LEVEL OF SERVICES PROVIDED

TYPE OF SERVICE PROVIDED	AVERAGE LEVEL OF SERVICE*		PERCENT OF USERS REQUIRING		
	REQUIRED	RECEIVED	Less than the Average Level of Service Provided (OVERKILL)	Equal or Greater than Average Level of Service and Get It (SATISFIED)	Equal or Greater than Average Level of Service and Receive Less (DISSATISFIED)
Environmental Planning	4.6	3.7	50.0%	20.0%	30.0%
Physical Site Planning	4.0	3.4	60.0	20.0	20.0
Consulting	4.5	2.9	46.7	30.0	23.3
Documentation	6.7	4.8	30.0	16.7	53.3
Training	5.4	4.8	36.7	43.3	20.0
Installation Planning	4.2	3.4	53.3	20.0	26.7
Hardware Maintenance	8.2	7.0	26.7	26.7	46.6
Software Maintenance	4.6	3.8	46.7	23.3	30.0
Supplies Sales	6.4	6.3	43.3	30.0	26.7
Add-on Sales	3.7	3.4	53.3	30.0	16.7
Site Audits	2.6	1.6	73.3	13.4	13.3
Relocation	2.4	1.9	76.7	20.0	3.3
De-Installation	4.6	4.9	36.7	56.6	6.7

\*Rating: 1 = Low, 10 = High

Areas requiring attention

## EXHIBIT III-6

COMPUTERVISION USER REQUIREMENTS FOR SERVICES,  
VERSUS LEVEL OF SERVICES PROVIDED

TYPE OF SERVICE PROVIDED	AVERAGE LEVEL OF SERVICE*		PERCENT OF USERS REQUIRING		
	REQUIRED	RECEIVED	Less than the Average Level of Service Provided (OVERKILL)	Equal or Greater than Average Level of Service and Get It (SATISFIED)	Equal or Greater than Average Level of Service and Receive Less (DISSATISFIED)
Environmental Planning	3.8	3.9	52.6%	36.9%	10.5%
Physical Site Planning	3.4	3.6	57.8	37.0	5.2
Consulting	4.3	4.0	47.3	31.7	21.0
Documentation	8.2	6.4	15.7	15.9	68.4
Training	5.4	6.1	42.1	26.3	31.6
Installation Planning	3.4	3.1	57.8	31.7	10.5
Hardware Maintenance	8.7	8.1	36.8	21.1	42.1
Software Maintenance	8.7	5.8	31.6	10.5	57.9
Supplies Sales	6.1	0.7	36.8	5.3	57.9
Add-on Sales	6.5	5.1	36.8	26.4	36.8
Site Audits	3.9	3.6	42.1	47.4	10.5
Relocation	4.8	4.2	47.3	26.4	26.3
De-Installation	2.9	2.2	31.6	10.5	57.9

\*Rating: 1 = Low, 10 = High



Areas requiring attention

#### 4. DATA GENERAL

- The small systems analyzed were the Eclipse, CS/50, and NOVA systems users.
- The overall after-sales support picture for Data General is quite good, but three critical areas are substantially below par:
  - Documentation (over 40% of users dissatisfied).
  - Hardware maintenance (over 45% dissatisfied).
  - Supplies sales (over 65% dissatisfied).
- Data General has a reasonable rating on software maintenance, however, unlike many of its competitors. The environmental planning, installation planning, physical site planning, and consulting services are all above the average needed by the user base.
- Exhibit III-7 provides the analysis.

#### 5. DATAPOINT

- The user sample surveyed was comprised exclusively of 6600 system users.
- Many of the key service areas have uncomfortably high percentages of users who are dissatisfied with the level of service received:
  - Training.
  - Hardware maintenance.
  - Software maintenance.
  - Supplies sales.

## EXHIBIT III-7

DATA GENERAL USER REQUIREMENTS FOR SERVICES,  
VERSUS LEVEL OF SERVICES PROVIDED

TYPE OF SERVICE PROVIDED	AVERAGE LEVEL OF SERVICE*		PERCENT OF USERS REQUIRING		
	REQUIRED	RECEIVED	Less than the Average Level of Service Provided (OVERKILL)	Equal or Greater than Average Level of Service and Get It (SATISFIED)	Equal or Greater than Average Level of Service and Receive Less (DISSATISFIED)
Environmental Planning	3.9	4.1	53.3%	26.7%	20.0%
Physical Site Planning	3.7	3.4	60.0	26.7	13.3
Consulting	4.0	4.3	50.0	33.3	16.7
Documentation	6.2	5.7	33.3	23.4	43.3
Training	4.6	3.7	40.0	33.3	26.7
Installation Planning	4.6	3.7	50.0	23.4	26.6
Hardware Maintenance	8.8	8.4	30.0	23.3	46.7
Software Maintenance	3.7	2.4	56.0	10.7	33.3
Supplies Sales	5.6	2.3	16.6	16.8	66.6
Add-on Sales	5.1	5.5	50.0	26.7	23.3
Site Audits	2.8	2.0	66.6	20.1	13.3
Relocation	3.7	2.7	56.7	20.0	23.3
De-Installation	3.1	2.3	63.3	20.1	16.6

\*Rating: 1 = Low, 10 = High



Areas requiring attention

- In addition, three other areas require some attention:
  - Documentation.
  - Installation planning.
  - Add-on sales.
- Nevertheless, none of the services surveyed is rated by a majority of Data-point users as unsatisfactory, which is promising. If the average level of service can be raised slightly in the above key areas, the overall satisfaction would be very good.
- Exhibit III-8 provides the detailed analysis.

## 6. DIGITAL EQUIPMENT CORPORATION

- The DEC products surveyed included the PDP 11/34, 40, 44, 45, and 70.
- Overall, DEC performs well in the eyes of its users but falls significantly short on software maintenance and supplies sales. In addition, documentation, service, hardware maintenance, physical site planning, and add-on sales are rated moderately unsatisfactory.
- With so many installations, it is no doubt difficult for DEC to be uniformly responsive to the varying needs of its installed base, but the service level in all of the above-mentioned areas needs to be improved. This will mean a significant effort (and cost) for DEC.
- Exhibit III-9 provides the detailed analysis.

## EXHIBIT III-8

DATAPoint USER REQUIREMENTS FOR SERVICES,  
VERSUS LEVEL OF SERVICES PROVIDED

TYPE OF SERVICE PROVIDED	AVERAGE LEVEL OF SERVICE*		PERCENT OF USERS REQUIRING		
	REQUIRED	RECEIVED	Less than the Average Level of Service Provided (OVERKILL)	Equal or Greater than Average Level of Service and Get It (SATISFIED)	Equal or Greater than Average Level of Service and Receive Less (DISSATISFIED)
Environmental Planning	4.1	4.4	55.0%	40.0%	5.0%
Physical Site Planning	4.2	3.7	55.0	40.0	5.0
Consulting	3.8	3.4	50.0	30.0	20.0
Documentation	6.5	5.8	40.0	25.0	35.0
Training	5.9	4.9	45.0	10.0	45.0
Installation Planning	4.1	2.9	50.0	20.0	30.0
Hardware Maintenance	8.0	8.0	30.0	25.0	45.0
Software Maintenance	5.6	5.2	40.0	15.0	45.0
Supplies Sales	5.4	3.9	40.0	20.0	40.0
Add-on Sales	4.9	4.2	35.0	35.0	30.0
Site Audits	2.0	1.4	75.0	25.0	0.0
Relocation	4.0	3.7	50.0	40.0	10.0
De-Installation	5.0	5.4	50.0	30.0	20.0

\*Rating: 1 = Low, 10 = High



Areas requiring attention

## EXHIBIT III-9

DIGITAL EQUIPMENT USER REQUIREMENTS FOR SERVICES,  
VERSUS LEVEL OF SERVICES PROVIDED

TYPE OF SERVICE PROVIDED	AVERAGE LEVEL OF SERVICE *		PERCENT OF USERS REQUIRING		
	REQUIRED	RECEIVED	Less than the Average Level of Service Provided (OVERKILL)	Equal or Greater than Average Level of Service and Get It (SATISFIED)	Equal or Greater than Average Level of Service and Receive Less (DISSATISFIED)
Environmental Planning	4.3	3.3	51.6%	25.8%	22.6%
Physical Site Planning	4.3	2.8	48.4	22.6	29.0
Consulting	3.7	2.8	45.2	29.0	25.8
Documentation	6.5	5.5	41.9	19.4	38.7
Training	3.9	3.2	54.8	22.6	22.6
Installation Planning	4.1	3.3	51.6	32.3	16.1
Hardware Maintenance	7.6	7.8	32.3	32.3	35.4
Software Maintenance	4.5	3.4	41.9	12.9	45.2
Supplies Sales	4.9	2.6	41.9	16.2	41.9
Add-on Sales	4.3	3.2	48.4	22.5	29.1
Site Audits	2.8	1.4	61.3	12.9	25.8
Relocation	4.2	3.7	51.6	29.0	19.4
De-Installation	3.6	2.2	61.3	19.3	19.4

\* Rating: 1 = Low, 10 = High



Areas requiring attention

## 7. FOUR PHASE

- The Four Phase products surveyed included the IV-40, 50, 65, 70, 90, and 95.
- The overall service picture is quite good, with user dissatisfaction kept at moderate levels except for software maintenance and supplies sales, where a majority of users receive service at a level less than that needed.
- In the 35-40% dissatisfied range, the common faults of other vendors emerge in the Four Phase service.
  - Documentation less than satisfying (35%).
  - Training less than satisfying (35%).
  - Hardware maintenance (40% dissatisfied).
- Nevertheless, compared to other vendors the overall service picture is moderately good.
- Exhibit III-10 provides the detailed analysis.

## 8. HEWLETT-PACKARD

- The HP small systems analyzed were exclusively HP 3000s.
- Three areas of service require attention, each of which shows more than 40% of users dissatisfied with the average level of service required:
  - Documentation.
  - Hardware maintenance.
  - Software maintenance.

## EXHIBIT III-10

FOUR PHASE USER REQUIREMENTS FOR SERVICES,  
VERSUS LEVEL OF SERVICES PROVIDED

TYPE OF SERVICE PROVIDED	AVERAGE LEVEL OF SERVICE*		PERCENT OF USERS REQUIRING		
	REQUIRED	RECEIVED	Less than the Average Level of Service Provided (OVERKILL)	Equal or Greater than Average Level of Service and Get It (SATISFIED)	Equal or Greater than Average Level of Service and Receive Less (DISSATISFIED)
Environmental Planning	3.3	2.6	50.0	30.0	20.0
Physical Site Planning	3.7	3.0	55.0	25.0	20.0
Consulting	3.0	2.6	45.0	35.0	20.0
Documentation	6.1	5.2	45.0	20.0	35.0
Training	4.9	4.8	45.0	20.0	35.0
Installation Planning	3.8	2.3	60.0	15.0	25.0
Hardware Maintenance	8.5	7.4	35.0	25.0	40.0
Software Maintenance	6.7	5.2	35.0	15.0	50.0
Supplies Sales	5.0	1.0	40.0	5.0	55.0
Add-on Sales	4.5	3.8	45.0	35.0	20.0
Site Audits	1.9	0.6	70.0	10.0	20.0
Relocation	3.1	2.1	55.0	25.0	20.0
De-Installation	3.9	3.8	50.0	35.0	15.0

\* Rating: 1 = Low, 10 = High



Areas requiring attention

- Apart from these three areas (each of which is a major area of concern) the overall picture of HP service is very good.
- Exhibit III-11 provides the detailed analysis.

## 9. HONEYWELL

- The Honeywell small systems analyzed were the DPS 6 and the low end of the series 60.
- Honeywell's small-system service performance is far better than the large-system service picture (compare Exhibit III-12 in this report with Exhibit III-7 of INPUT's Large-Scale System User Requirements report). The overall picture is well balanced, with the exception of:
  - Documentation (half of the users interviewed dissatisfied).
  - Software maintenance (over 40% dissatisfied).
  - Supplies sales (over 40% dissatisfied).
- If it were not for these three areas, Honeywell's service performance would be only slightly inferior to IBM's. Exhibit III-12 provides the detailed analysis.

## 10. IBM

- The IBM small systems researched included the system/32, /34, 8100 and the Series/I.
- Similar to the result obtained by IBM in the large-scale user requirements study, IBM outscores all other vendors on overall service performance in the small-scale systems area.

## EXHIBIT III-11

HEWLETT-PACKARD USER REQUIREMENTS FOR SERVICES,  
VERSUS LEVEL OF SERVICES PROVIDED

TYPE OF SERVICE PROVIDED	AVERAGE LEVEL OF SERVICE*		PERCENT OF USERS REQUIRING		
	REQUIRED	RECEIVED	Less than the Average Level of Service Provided (OVERKILL)	Equal or Greater than Average Level of Service and Get It (SATISFIED)	Equal or Greater than Average Level of Service and Receive Less (DISSATISFIED)
Environmental Planning	4.5	4.5	50.0%	35.0%	15.0%
Physical Site Planning	5.1	5.8	35.0	45.0	20.0
Consulting	4.3	5.0	40.0	40.0	20.0
Documentation	6.9	6.6	30.0	30.0	40.0
Training	6.1	6.4	50.0	25.0	25.0
Installation Planning	5.5	6.0	45.0	25.0	30.0
Hardware Maintenance	8.4	8.0	30.0	25.0	45.0
Software Maintenance	7.6	7.0	40.0	15.0	45.0
Supplies Sales	5.5	4.4	40.0	40.0	20.0
Add-on Sales	5.1	5.6	35.0	50.0	15.0
Site Audits	3.7	2.1	40.0	35.0	25.0
Relocation	4.7	3.7	35.0	40.0	25.0
De-Installation	5.0	3.7	40.0	40.0	20.0

\*Rating: 1 = Low, 10 = High

Areas requiring attention

## EXHIBIT III-12

HONEYWELL USER REQUIREMENTS FOR SERVICES,  
VERSUS LEVEL OF SERVICES PROVIDED

TYPE OF SERVICE PROVIDED	AVERAGE LEVEL OF SERVICE*		PERCENT OF USERS REQUIRING		
	REQUIRED	RECEIVED	Less than the Average Level of Service Provided (OVERKILL)	Equal or Greater than Average Level of Service and Get It (SATISFIED)	Equal or Greater than Average Level of Service and Receive Less (DISSATISFIED)
Environmental Planning	5.4	5.9	53.3%	33.4%	13.3%
Physical Site Planning	5.6	6.4	46.7	40.0	13.3
Consulting	4.9	4.8	33.4	43.3	23.3
Documentation	6.6	5.4	43.4	6.6	50.0
Training	6.2	5.1	40.0	30.0	30.0
Installation Planning	5.2	5.3	50.0	30.0	20.0
Hardware Maintenance	8.4	7.9	50.0	20.0	30.0
Software Maintenance	6.1	5.1	33.3	23.3	43.4
Supplies Sales	5.7	4.1	43.3	10.0	46.7
Add-on Sales	5.6	5.5	40.0	26.7	33.3
Site Audits	3.4	2.3	53.3	13.4	33.3
Relocation	4.5	4.5	50.0	36.7	13.3
De-Installation	4.2	3.2	43.3	36.7	20.0

\*Rating: 1 = Low, 10 = High

Areas requiring attention

- Only two areas of service show over 30% of dissatisfied users:
  - Hardware maintenance.
  - Supplies sales.
- IBM scores the highest levels of satisfied users across the spectrum of user requirements of all of the 15 small-systems vendors analyzed.
- Exhibit III-13 provides the detailed analysis.

## 11. INTERGRAPH

- The sample interviews were entirely based on the Intergraph IGS system.
- The Intergraph service picture is a very uneven one, with a mixture of high satisfaction (e.g., physical site planning, consulting, add-on sales) and high dissatisfaction (e.g., documentation, hardware maintenance, software maintenance). The picture is typical of a young corporation, but Intergraph now needs to improve its basic service performance if it is to create a stable, satisfied base of users.
- Exhibit III-14 provides the detailed analysis.

## 12. NCR

- The NCR products surveyed in the small-scale system area included the 8200 and the I-9000 series.
- Two areas of serious user dissatisfaction spoil the good overall service picture, and they are both major ones:

## EXHIBIT III-13

IBM USER REQUIREMENTS FOR SERVICES,  
VERSUS LEVEL OF SERVICES PROVIDED

TYPE OF SERVICE PROVIDED	AVERAGE LEVEL OF SERVICE*		PERCENT OF USERS REQUIRING		
	REQUIRED	RECEIVED	Less than the Average Level of Service Provided (OVERKILL)	Equal or Greater than Average Level of Service and Get It (SATISFIED)	Equal or Greater than Average Level of Service and Receive Less (DISSATISFIED)
Environmental Planning	4.3	5.1	55.0%	37.5%	7.5%
Physical Site Planning	3.5	5.0	52.5	45.0	2.5
Consulting	3.8	4.5	55.0	37.5	7.5
Documentation	6.5	6.5	45.0	35.0	20.0
Training	5.7	5.6	47.5	27.5	25.0
Installation Planning	4.9	5.1	40.0	45.0	15.0
Hardware Maintenance	7.9	8.5	37.5	30.5	32.0
Software Maintenance	6.2	5.7	40.0	35.0	25.0
Supplies Sales	5.5	3.9	47.5	15.0	37.5
Add-on Sales	4.4	4.6	40.0	45.0	15.0
Site Audits	3.0	1.7	52.5	25.0	22.5
Relocation	4.3	3.1	47.5	32.5	20.0
De-Installation	4.7	4.4	42.5	45.0	12.5

\*Rating: 1 = Low, 10 = High

Areas requiring attention

## EXHIBIT III-14

INTERGRAPH USER REQUIREMENTS FOR SERVICES,  
VERSUS LEVEL OF SERVICES PROVIDED

TYPE OF SERVICE PROVIDED	AVERAGE LEVEL OF SERVICE *		PERCENT OF USERS REQUIRING		
	REQUIRED	RECEIVED	Less than the Average Level of Service Provided (OVERKILL)	Equal or Greater than Average Level of Service and Get It (SATISFIED)	Equal or Greater than Average Level of Service and Receive Less (DISSATISFIED)
Environmental Planning	4.2	5.8	50.0%	20.0%	30.0%
Physical Site Planning	4.3	6.0	50.0	40.0	10.0
Consulting	4.8	6.0	40.0	45.0	15.0
Documentation	8.4	5.0	25.0	15.0	60.0
Training	7.7	6.7	35.0	25.0	40.0
Installation Planning	5.7	5.8	55.0	15.0	30.0
Hardware Maintenance	9.2	7.8	25.0	30.0	45.0
Software Maintenance	8.3	6.3	30.0	5.0	65.0
Supplies Sales	2.8	1.5	65.0	15.0	20.0
Add-on Sales	5.4	6.0	55.0	30.0	15.0
Site Audits	4.2	3.0	40.0	40.0	20.0
Relocation	5.2	1.8	35.0	20.0	45.0
De-Installation	4.3	1.5	40.0	10.0	50.0

\*Rating: 1 = Low, 10 = High

Areas requiring attention

- Hardware maintenance (where more than half the users interviewed were dissatisfied).
- Software maintenance (with over 40% dissatisfied).
- Three further areas of moderate dissatisfaction must be added, all of which show one-third of the users dissatisfied:
  - Documentation.
  - User training.
  - Add-on sales.
- Exhibit III-15 provides the detailed analysis.

### 13. PRIME

- The PRIME users interviewed were either PRIME 300, 400, or 500 users.
- Four major areas of user dissatisfaction should concern PRIME, all of which are basic service requirements:
  - Hardware maintenance (55% of users dissatisfied).
  - Software maintenance (40% of users dissatisfied).
  - Supplies sales (60% of users dissatisfied).
  - Add-on sales (40% of users dissatisfied).
- Without satisfactory resolution of these key problem areas, PRIME's overall small-system service performance must be judged as poor.
- Exhibit III-16 provides the detailed analysis.

## EXHIBIT III-15

NCR USER REQUIREMENTS FOR SERVICES,  
VERSUS LEVEL OF SERVICES PROVIDED

TYPE OF SERVICE PROVIDED	AVERAGE LEVEL OF SERVICE*		PERCENT OF USERS REQUIRING		
	REQUIRED	RECEIVED	Less than the Average Level of Service Provided (OVERKILL)	Equal or Greater than Average Level of Service and Get It (SATISFIED)	Equal or Greater than Average Level of Service and Receive Less (DISSATISFIED)
Environmental Planning	3.8	3.8	47.6%	38.1%	14.3%
Physical Site Planning	3.9	3.3	52.4	28.5	19.1
Consulting	4.6	4.3	38.1	42.8	19.1
Documentation	7.0	6.6	38.1	28.6	33.3
Training	4.8	4.1	38.1	28.6	33.3
Installation Planning	4.2	4.2	47.6	42.9	9.5
Hardware Maintenance	8.8	7.9	19.1	23.8	57.1
Software Maintenance	7.3	4.7	42.9	14.2	42.9
Supplies Sales	5.6	3.9	42.9	33.3	23.8
Add-on Sales	5.6	4.5	38.1	28.6	33.3
Site Audits	2.9	2.6	57.1	33.4	9.5
Relocation	3.6	3.3	57.1	28.6	14.3
De-Installation	3.9	3.4	52.4	28.5	19.1

\*Rating: 1 = Low, 10 = High

Areas requiring attention

## EXHIBIT III-16

PRIME USER REQUIREMENTS FOR SERVICES,  
VERSUS LEVEL OF SERVICES PROVIDED

TYPE OF SERVICE PROVIDED	AVERAGE LEVEL OF SERVICE*		PERCENT OF USERS REQUIRING		
	REQUIRED	RECEIVED	Less than the Average Level of Service Provided (OVERKILL)	Equal or Greater than Average Level of Service and Get It (SATISFIED)	Equal or Greater than Average Level of Service and Receive Less (DISSATISFIED)
Environmental Planning	3.6	4.2	55.0%	30.0%	15.0%
Physical Site Planning	3.6	3.8	55.0	35.0	10.0
Consulting	3.7	3.6	55.0	30.0	15.0
Documentation	6.3	5.9	35.0	35.0	30.0
Training	4.1	4.2	50.0	35.0	15.0
Installation Planning	3.1	3.3	60.0	25.0	15.0
Hardware Maintenance	8.1	8.5	30.0	15.0	55.0
Software Maintenance	6.2	4.5	45.0	15.0	40.0
Supplies Sales	5.0	1.2	35.0	5.0	60.0
Add-on Sales	6.4	4.8	40.0	20.0	40.0
Site Audits	3.3	1.9	50.0	30.0	20.0
Relocation	4.3	4.0	45.0	40.0	15.0
De-Installation	4.2	2.3	45.0	20.0	35.0

\*Rating: 1 = Low, 10 = High



Areas requiring attention

## 14. TEXAS INSTRUMENTS

- The TI sample was composed entirely of TI 990 users.
- The overall TI service picture is good in the key areas (hardware and software maintenance), excellent in the planning activities (environmental planning, physical site planning, consulting, installation planning) but poor in the follow-up activities of documentation, supplies sales, and site audits.
- None of the poorly rated areas impact true customer satisfaction, but all contribute to downgrading what would otherwise be an excellent small-system service record.
- Exhibit III-17 provides the detailed analysis.

## EXHIBIT III-17

TEXAS INSTRUMENTS USER REQUIREMENTS FOR SERVICES,  
VERSUS LEVEL OF SERVICES PROVIDED

TYPE OF SERVICE PROVIDED	AVERAGE LEVEL OF SERVICE*		PERCENT OF USERS REQUIRING		
	REQUIRED	RECEIVED	Less than the Average Level of Service Provided (OVERKILL)	Equal or Greater than Average Level of Service and Get It (SATISFIED)	Equal or Greater than Average Level of Service and Receive Less (DISSATISFIED)
Environmental Planning	3.0	2.6	65.0%	30.0%	5.0%
Physical Site Planning	2.5	1.6	70.0	15.0	15.0
Consulting	3.2	2.9	50.0	40.0	10.0
Documentation	6.4	5.2	35.0	15.0	50.0
Training	4.7	3.9	35.0	30.0	35.0
Installation Planning	2.5	1.7	65.0	20.0	15.0
Hardware Maintenance	7.8	7.9	25.0	45.0	30.0
Software Maintenance	4.3	3.1	45.0	35.0	20.0
Supplies Sales	4.5	1.6	35.0	0.0	65.0
Add-on Sales	5.1	4.4	30.0	40.0	30.0
Site Audits	1.7	0.5	0.0	10.0	90.0
Relocation	2.9	1.5	60.0	20.0	20.0
De-Installation	2.2	1.1	70.0	20.0	10.0

\*Rating: 1 = Low, 10 = High



Areas requiring attention



## IV MAINTENANCE REQUIREMENTS



## IV MAINTENANCE REQUIREMENTS

### A. SYSTEM AVAILABILITY

- Users in the manufacturing environment require significantly greater system availability. As small systems become more involved in business operations, this is a situation that the industry as a whole will face. Users will become more demanding because of interruptions in productivity.
- At this time, most vendors are meeting or exceeding user requirements. Manufacturing systems are not meeting requirements, but their performance is equal to or better than the performance of business systems.
- System availability during critical periods averages about 97%, which may create more demands for performance guarantees in the future. A standard method for measuring system availability must be established.
- Exhibits IV-1 and IV-2 display uptime performance by all vendors represented in the user survey.
- The average response time to hardware calls, as shown in Exhibit IV-3, is distorted by the users of Texas Instruments, Autotrol, and Intergraph. Removal of these three sets of data produces a 3.1-hour required response (versus a 3.3-hour actual).

EXHIBIT IV-1  
OVERALL SYSTEM AVAILABILITY BY VENDOR  
(percent)

VENDORS	MEAN (percent)		MEDIAN		NUMBER OF RESPONSES	
	Required	Actual	Required	Actual	Required	Actual
All Vendors	93.82%	94.35%	96.0%	99.0%	340	342
Autotrol	97.3	95.5	98.0	97.0	21	21
Burroughs	92.6	91.9	95.5	95.0	30	30
Computervision	94.0	95.3	96.0	96.0	19	19
DEC	95.4	95.9	95.9	98.0	30	31
Data General	93.2	95.8	97.5	97.0	30	30
Datapoint	91.5	94.0	95.0	95.0	20	20
Four Phase	93.8	93.7	95.0	95.0	20	20
Hewlett-Packard	95.8	95.5	96.0	95.0	20	20
Honeywell	94.1	94.7	98.0	96.5	30	30
IBM	91.9	93.8	95.0	95.5	39	40
Intergraph	96.2	94.3	96.0	95.5	20	20
NCR	90.7	94.2	95.0	95.0	21	21
Prime	93.3	92.9	99.0	96.0	20	20
Texas Instruments	95.3	94.4	95.0	98.0	20	20

## EXHIBIT IV-2

## SYSTEM AVAILABILITY DURING CRITICAL PERIODS BY VENDOR

VENDORS	PERCENT SYSTEM AVAILABILITY				NUMBER OF RESPONSES
	MEAN	STANDARD DEVIATION	MEDIAN	MODE	
All Vendors	97.7%	5.3%	99.0%	100.0%	306
Autotrol	97.6	1.8	98.0	99.0	21
Burroughs	N/A	N/A	N/A	N/A	N/A
Computervision	96.9	4.4	99.0	100.0	19
DEC	97.9	2.7	99.0	100.0	30
Data General	96.3	8.5	99.9	100.0	30
Datapoint	94.9	7.0	97.0	100.0	20
Four Phase	98.4	2.5	99.0	100.0	20
Hewlett-Packard	97.3	2.7	98.0	95.0	19
Honeywell	97.5	4.45	99.0	100.0	30
IBM	94.6	9.9	98.7	95.0	38
Intergraph	96.9	2.5	97.5	99.0	20
NCR	96.8	3.9	98.5	100.0	20
Prime	98.9	2.5	99.0	100.0	19
Texas Instruments	97.1	3.4	99.0	95.0	20

EXHIBIT IV-3

RESPONSE TIME TO HARDWARE FAILURES

VENDOR	MEAN TIME (hours)		MEDIAN TIME (hours)		NUMBER OF RESPONSES
	Required	Actual	Required	Actual	
All Vendors	4.45	4.82	2.0	2.0	341
Autotrol	11.48	14.29	8.0	8.0	21
Burroughs	4.76	6.17	3.0	3.0	30
Computervision	4.37	3.47	4.0	4.0	19
DEC	3.10	2.54	2.0	2.0	31
Data General	3.53	3.21	2.0	2.0	30
Datapoint	2.25	2.50	1.5	1.8	20
Four Phase	2.87	1.84	2.0	1.8	20
Hewlett-Packard	3.60	2.92	3.0	2.0	20
Honeywell	2.63	2.96	2.0	1.0	30
IBM	3.89	3.51	2.0	2.0	39
Intergraph	7.85	8.65	4.0	4.0	20
NCR	2.28	2.88	2.0	2.0	21
Prime	3.03	2.34	2.0	1.0	20
Texas Instruments	9.68	13.68	8.0	10.0	20

- As shown in Exhibit IV-4, users are less satisfied with response time to software calls than they are with response to hardware failures.
  - On the average, vendors take nearly twice as long to respond to system software failures as users believe is reasonable.
  - Severity of user problems with software has little relative effect on the responsiveness of vendors.
- Responsiveness is the barometer by which the user measures the attitudes and capabilities of the vendor's support structure. Dissatisfaction with responsiveness affects all areas and could be the key to the software maintenance deficiencies felt by most users.
- As shown in Exhibit IV-5, overall responsiveness is significantly correlated to the individual measurements of user satisfaction that are discussed throughout this report.

## B. SITE MANAGEMENT AND SERVICE OPPORTUNITIES

- Site management in the small-system sector is significantly different from that in the large-system group.
  - Large volumes make it difficult to be cost effective.
  - Costs passed on to the user must be kept at a reasonable level.
- Site management has always been the key to increasing system sales.
  - By understanding the users' needs and providing tailored solutions as examples, IBM has built a stable customer base.

## EXHIBIT IV-4

## RESPONSE TIME TO SOFTWARE FAILURES

VENDORS	MEAN TIME FOR RESPONSE (hours)						NUMBER OF RESPONSES
	SYSTEM DOWN		SYSTEM SEVERELY DEGRADED		Required	Actual	
All Vendors	3.43	6.32	5.04	8.37	27.49	28.82	145
Autotrol	5.11	5.11	12.60	12.60	47.47	52.70	9
Burroughs	5.08	14.42	5.54	15.42	33.20	31.40	13
Computervision	3.62	10.85	6.38	12.19	26.21	38.21	13
DEC	2.67	4.22	2.78	4.22	23.80	N/A	9
Data General	1.04	1.04	2.14	3.44	3.74	3.74	5
Datapoint	1.43	1.63	2.56	7.22	29.05	28.60	8
Four Phase	2.98	3.16	3.16	3.35	14.95	22.87	11
Hewlett-Packard	1.98	3.35	5.75	14.25	9.24	17.00	11
Honeywell	2.24	1.00	2.58	1.59	17.81	4.56	16
IBM	2.76	5.85	4.54	6.51	10.21	9.91	12
Intergraph	3.65	3.86	4.31	4.00	34.62	34.62	14
NCR	2.29	6.46	3.38	7.31	13.00	23.57	12
Prime	1.38	0.63	5.17	3.94	33.33	16.00	4
Texas Instruments	11.25	24.37	11.25	24.37	170.40	155.80	8

**EXHIBIT IV-5**  
**USER RATINGS OF THE**  
**GENERAL RESPONSIVENESS OF THE VENDOR ORGANIZATION**

VENDORS	RATINGS (1-10)				NUMBER OF RESPONSES
	MEAN	STANDARD DEVIATION	MEDIAN	MODE	
All Vendors	7.51	1.99	8.0	8.0	342
Autotrol	6.00	1.45	6.0	5.0	21
Burroughs	6.90	2.43	7.0	9.0	30
Computervision	7.05	2.25	7.0	10.0	19
DEC	7.80	2.06	8.0	9.0	31
Data General	8.00	1.64	8.0	10.0	30
Datapoint	7.85	1.98	9.0	9.0	20
Four Phase	7.45	2.06	8.0	8.0	20
Hewlett-Packard	7.80	1.61	8.0	7.0	20
Honeywell	7.33	1.99	8.0	8.0	30
IBM	7.95	1.78	8.0	8.0	40
Intergraph	7.50	1.82	7.5	7.0	20
NCR	7.48	1.78	8.0	8.0	21
Prime	8.45	1.54	9.0	9.0	20
Texas Instruments	7.30	2.49	8.0	9.0	20

- Over the years, the cost of this service has steadily increased, discouraging many vendors from making a commitment for the future.
- Cost of ownership has become an important ingredient in the user's purchasing decisions. However, the user still expects traditional levels of service.
- It is recommended that vendors move toward a total service concept; this allows field engineers to become effective marketing arms.
- The passing of these responsibilities to field service will create new business opportunities and reduce overall operating costs.
- Some vendor field organizations are exploring the one clear opportunity: the maintenance of noncompetitive, complementary equipment that is not directly sold by the vendor. This creates some support problems, but does allow field organizations to be somewhat removed from variations in the sales cycle.

### C. THIRD-PARTY MAINTENANCE REQUIREMENTS

- Users of small systems seem reluctant to use third-party maintenance. The overall satisfaction with hardware maintenance and the complexity of software make such a move unsettling.
- According to the survey results shown in Exhibit IV-6, TPM (third-party maintenance) organizations now have about 25% of the marketplace.
- The vendor requirement for TPM is definite and, over the next several years, should expand into remote locations.

## EXHIBIT IV-6

## USER CONSIDERATION OF THIRD-PARTY MAINTENANCE

VENDORS	NOW USING TPM (percent)			CONSIDERED TPM AS SINGLE SOURCE (percent)			WOULD CONSIDER MANAGEMENT CONTRACT AS ALTERNATIVE			NUMBER OF RESPONSES
	YES	NO	N/A	YES	NO	N/A	YES	NO	N/A	
All Vendors	22.5%	77.5%	-	17.3%	81.0%	1.7%	23.4%	71.6%	5.0%	342
Autotrol	-	100.0	-	4.8	95.2	-	-	100.0	-	21
Burroughs	20.0	80.0	-	3.3	96.7	-	30.0	70.0	-	30
Computervision	31.6	68.4	-	31.6	68.4	-	26.3	73.7	-	19
DEC	45.2	54.8	-	35.5	61.3	3.2	32.3	64.5	3.2	31
Data General	30.0	70.0	-	26.7	73.3	-	30.0	60.0	10.0	30
Datapoint	15.0	85.0	-	5.0	95.0	-	5.0	85.0	10.0	20
Four Phase	-	100.0	-	5.0	95.0	-	25.0	70.0	5.0	20
Hewlett-Packard	25.0	75.0	-	20.0	75.0	5.0	20.0	75.0	5.0	20
Honeywell	13.3	86.7	-	20.0	73.3	6.7	36.7	56.7	6.7	30
IBM	22.5	77.5	-	12.5	82.5	5.0	22.5	65.0	12.5	40
Intergraph	15.0	85.0	-	-	100.0	-	-	100.0	-	20
NCR	19.0	81.0	-	9.5	90.5	-	19.0	81.0	-	21
Prime	45.0	55.0	-	20.0	80.0	-	25.0	70.0	5.0	20
Texas Instruments	25.0	75.0	-	45.0	55.0	-	40.0	55.0	5.0	20

- Vendors of small systems must have the opportunity to continually expand their installed base. Vendors will require new service locations in places where no service personnel are presently located.
  - Today, many companies charge premium rates for travel. This policy creates cost-of-ownership sales resistance.
  - The logical alternative is to use agents or third-party maintenance companies.
  - In the future, software maintenance will face this same problem and will be forced to make the same decisions.
- If vendors consider third-party maintenance a threat to their operations, they may be faced with a limited market.
- The requirement for single-source maintenance, as reflected in Exhibit IV-7, reveals many potential opportunities for sales in areas where maintenance vendors have established a reputation as responsive organizations that are capable of coordinating all the support requirements necessary to problem resolution.

## EXHIBIT IV-7

## IMPORTANCE OF SINGLE SOURCE OF MAINTENANCE

VENDORS	RATINGS (1-10)				NUMBER OF RESPONSES
	MEAN	STANDARD DEVIATION	MEDIAN	MODE	
All Vendors	8.04	2.41	9.0	10.0	340
Autotrol	8.04	2.82	9.0	10.0	21
Burroughs	8.53	1.81	8.5	10.0	30
Computervision	8.31	2.26	10.0	10.0	19
DEC	8.48	2.36	9.0	10.0	31
Data General	7.67	2.70	8.5	10.0	30
Datapoint	8.75	1.45	9.0	10.0	20
Four Phase	7.37	3.25	9.0	10.0	19
Hewlett-Packard	7.85	2.23	8.5	10.0	20
Honeywell	8.20	1.93	9.0	10.0	30
IBM	8.22	2.35	9.0	10.0	40
Intergraph	8.40	2.21	9.5	10.0	20
NCR	8.48	2.18	10.0	10.0	21
Prime	7.70	2.15	8.0	8.0	20
Texas Instruments	6.74	2.60	7.0	5.0	19



## V COMMUNICATIONS REQUIREMENTS



## V      COMMUNICATIONS REQUIREMENTS

### A.      COMMUNICATION WITH USERS

- Communication with users in a planned manner will become increasingly important as new service methods limit natural customer contact.
- Field service management communication, as shown in Exhibit V-1, and hardware service engineer communication, as shown in Exhibit V-2, appear to be appreciated by users. Half of all users rate these two categories with an 8 or above.
- Communication by software engineers, as shown in Exhibit V-3, is rated a full standard deviation below hardware personnel communications. Median values of software communications user ratings are much lower.

### B.      MARKETING SERVICES TO END USERS

- As shown in Exhibit V-4, marketable services are listed by their relative importance to users (most important first).
  - Guaranteed response time.
  - Preventive maintenance and field change during nonprime hours.

**EXHIBIT V-1**  
**USER RATINGS OF**  
**COMMUNICATION WITH SERVICE MANAGEMENT**

VENDORS	RATINGS (1-10)				NUMBER OF RESPONSES
	MEAN	STANDARD DEVIATION	MEDIAN	MODE	
All Vendors	7.30	1.89	8.0	8.0	332
Autotrol	6.47	1.47	7.0	7.0	21
Burroughs	7.00	2.30	8.0	8.0	29
Computervision	7.42	1.89	8.0	8.0	19
DEC	7.23	2.03	7.0	7.0	30
Data General	7.72	1.75	8.0	8.0	29
Datapoint	8.11	1.63	8.0	8.0	19
Four Phase	7.05	1.96	7.0	8.0	19
Hewlett-Packard	7.25	1.62	8.0	8.0	20
Honeywell	6.97	2.34	7.5	8.0	30
IBM	7.69	1.79	8.0	8.0	39
Intergraph	7.60	1.23	8.0	8.0	20
NCR	7.80	1.58	8.0	8.0	20
Prime	6.85	1.60	7.0	8.0	20
Texas Instruments	6.88	2.42	8.0	8.0	17

**EXHIBIT V-2**  
**USER RATINGS OF**  
**COMMUNICATION WITH HARDWARE SERVICE ENGINEERS**

VENDORS	RATINGS (1-10)				NUMBER OF RESPONSES
	MEAN	STANDARD DEVIATION	MEDIAN	MODE	
All Vendors	8.02	1.54	8.0	8.0	342
Autotrol	7.05	1.40	8.0	8.0	21
Burroughs	7.67	2.23	8.0	8.0	30
Computervision	8.26	1.92	8.0	8.0	19
DEC	8.35	1.60	9.0	9.0	31
Data General	7.86	1.53	8.0	9.0	30
Datapoint	8.10	1.25	8.0	8.0	20
Four Phase <sup>(1)</sup>	7.90	1.83	8.0	8.0	20
Hewlett-Packard	8.15	0.99	8.0	8.0	20
Honeywell	8.30	1.02	8.0	8.0	30
IBM	8.40	1.15	8.5	9.0	40
Intergraph	7.80	1.64	8.0	9.0	20
NCR	8.24	1.41	9.0	9.0	21
Prime	7.90	1.02	7.0	8.0	20
Texas Instruments	7.95	1.88	8.0	8.0	20

EXHIBIT V-3

USER RATINGS OF  
COMMUNICATION WITH SOFTWARE SERVICE ENGINEERS

VENDORS	RATINGS (1-10)				NUMBER OF RESPONSES
	MEAN	STANDARD DEVIATION	MEDIAN	MODE	
All Vendors	6.24	2.27	7.0	7.0	267
Autotrol	4.62	1.80	4.0	3.0	21
Burroughs	5.90	2.15	6.0	5.0	20
Computervision	5.37	2.24	5.0	5.0	19
DEC	6.52	2.25	7.0	8.0	21
Data General	6.43	2.82	7.0	5.0	14
Datapoint	7.53	1.96	8.0	8.0	15
Four Phase	6.13	2.70	7.0	7.0	16
Hewlett-Packard	6.89	1.91	7.0	6.0	19
Honeywell	6.08	2.56	7.0	5.0	25
IBM	7.09	1.96	7.5	8.0	32
Intergraph	5.61	2.09	6.0	7.0	18
NCR	6.11	2.28	7.0	5.0	19
Prime	6.73	2.12	7.0	8.0	15
Texas Instruments	6.38	1.85	6.0	6.0	13

## EXHIBIT V-4

USER RATINGS OF SERVICE  
REQUIREMENTS AND REASONABLE PREMIUMS

EXTENDED SERVICES	ALL VENDORS		REASONABLE PREMIUM	
	YES	PERCENT OF USERS	MEAN (percent)	MEDIAN (percent)
Standby Coverage During Critical Periods	73	21.4	5.6%	5.0%
Guaranteed Uptime	67	19.5	5.8	5.0
Guaranteed Response Time	133	38.9	4.1	1.0
On-Site Spare Parts	78	22.8	4.8	5.0
Remote Diagnostics	91	26.6	4.3	1.0
Preventive Maintenance and Field Changes During Off-hours	127	37.1	3.3	1.0
Occasional Shift Coverage	50	14.6	2.5	1.0
Full-time, On-site Service Engineer	12	3.5	2.2	0
Guaranteed Repair Time (Hardware)	83	24.3	4.6	1.0
Guaranteed Turnaround Time on Software Fixes	47	13.7	4.6	1.0

- Remote diagnostics.
- Guaranteed repair time.
- On-site spare parts.
- Standby coverage during critical periods.
- Guaranteed uptime.
- Occasional shift coverage.
- Guaranteed turnaround time on software fixes.
- Full-time service engineer.

- Reasonable premium percentages stated by users run from 2% to 6.0% (depending on priorities), as shown in Exhibit V-5.
- Variable shift coverage appears to be an area where effective marketing may produce significant revenues.
- Marketing of services could present vendors with increased third-party maintenance opportunities. Several independent depots offer repair services on parts, allowing TPM companies to compete more aggressively.
- Flexible maintenance packages that include a variety of services, including software, would give users a reason to stay with the vendor's support organization.

## EXHIBIT V-5

## REASONABLE PREMIUMS FOR EXTENDED SERVICES

EXTENDED SERVICES	PREMIUM GROUPS									NO PREMIUM CHARGE	
	PERCENTAGE USERS ARE WILLING TO PAY PREMIUM										
	0%	0-5%	5-10%	10-15%	15-20%	20-25%	25-30%	30-50%	>50%		
Standby Coverage During Critical Periods	19.2%	17.8%	26.0%	5.5%	-	1.4%	-	1.4%	-	28.7%	
Guaranteed Uptime	16.4	16.4	23.9	6.0	4.5%	-	1.5%	-	-	31.3	
Guaranteed Response Time	8.3	18.1	20.3	1.5	2.3	0.8	0.8	-	-	47.9	
On-Site Spare Parts	9.0	20.5	30.8	-	2.6	-	-	-	-	37.1	
Remote Diagnostics	8.8	13.2	28.6	1.1	1.1	1.1	-	-	-	46.1	
Preventive Maintenance and Field Changes During Off-hours	13.3	19.7	18.1	0.8	0.8	-	-	-	-	47.3	
Occasional Shift Coverage	26.0	24.0	10.0	-	-	-	-	-	-	40.0	
Full-time, On-site Service Engineer	8.3	8.3	-	-	8.3	-	-	-	-	75.0	
Guaranteed Repair Time (Hardware)	19.3	10.8	25.3	2.4	1.2	2.4	-	-	-	38.6	
Guaranteed Turn-Around Time on Software Fixes	19.3	10.8	25.3	2.4	1.2	2.4	-	-	-	37.2	

### C. USER RECEPTIVITY TO FIELD ENGINEERS IN SALES ROLES

- User receptivity to engineers in sales roles was generally favorable, with main opposition reserved for software packages and supplies. Strong feelings, either positive or negative, were minimal, as shown in Exhibits V-6 through V-11.
- Using engineers to sell upgrades and add-ons seems to be a logical step. Once this program is accepted, other services can be added.
- Serious study of the general personality of field engineers must dictate what services can be sold and what methods of remuneration should be used.
- Field service is typically considered a negative to most sales organizations. Product problems, dealing with customers, and maintenance charges are not exactly saleable items, but that is the world field service engineers live in, and anything that disrupts their ability to develop the necessary customer rapport could be disastrous. Also, field engineers are not trained in the art of selling. In the past, IBM has had successful programs that used FEs in sales roles, but the programs were carefully handled.
- A review of Exhibits V-6 through V-11 shows that supplies sales and software packages should not be included in the field engineering marketing plan.
  - FEs use supplies when repairing equipment; therefore it is understandable that users are somewhat reluctant to have FEs selling these same supplies to them.
  - One concern that must be addressed is whether users are confident of the overall business application knowledge of field service engineers.

**EXHIBIT V-6**

**USER RATINGS OF SERVICE ENGINEERS SELLING SUPPLIES**

VENDORS	FAVOR STRONGLY	FAVOR MILDLY	NEUTRAL	OPPOSE MILDLY	OPPOSE STRONGLY	NUMBER OF RESPONSES
All Vendors	1	119	40	147	35	342
Autotrol	-	10	-	10	1	21
Burroughs	-	12	4	10	4	30
Computervision	-	6	3	7	3	19
DEC	-	13	3	13	2	31
Data General	-	12	2	14	2	30
Datapoint	-	11	2	6	1	20
Four Phase	-	3	4	10	3	20
Hewlett-Packard	-	9	-	10	1	20
Honeywell	-	7	2	17	4	30
IBM	1	14	6	17	2	40
Intergraph	-	2	4	11	3	20
NCR	-	6	5	9	1	21
Prime	-	6	4	7	3	20
Texas Instruments	-	8	1	6	5	20

## EXHIBIT V-7

## USER RATINGS OF SERVICE ENGINEERS SELLING HARDWARE FIXTURES

VENDORS	FAVOR STRONGLY	FAVOR MILDLY	NEUTRAL	OPPOSE MILDLY	OPPOSE STRONGLY	NUMBER OF RESPONSES
All Vendors	8	199	24	93	18	342
Autotrol	-	10	-	10	1	21
Burroughs	1	15	3	8	3	30
Computervision	-	8	1	7	3	19
DEC	5	18	1	7	7	38
Data General	1	23	2	4	-	30
Datapoint	-	14	1	4	1	20
Four Phase	1	5	3	9	2	20
Hewlett-Packard	-	12	-	7	1	20
Honeywell	-	18	1	9	2	30
IBM	-	23	4	13	-	40
Intergraph	-	2	4	11	3	20
NCR	-	18	2	1	-	21
Prime	-	12	2	4	2	20
Texas Instruments	-	15	-	4	1	20

## EXHIBIT V-8

## USER RATINGS OF SERVICE ENGINEERS SELLING ADD-ON EQUIPMENT

VENDORS	FAVOR STRONGLY	FAVOR MILDLY	NEUTRAL	OPPOSE MILDLY	OPPOSE STRONGLY	NUMBER OF RESPONSES
All Vendors	9	186	25	103	19	342
Autotrol	-	9	-	11	1	21
Burroughs	1	16	3	6	4	30
Computervision	1	7	1	7	3	19
DEC	5	18	2	6	-	31
Data General	1	19	1	9	-	30
Datapoint	-	12	2	5	1	20
Four Phase	1	3	3	11	2	20
Hewlett-Packard	-	11	1	7	1	20
Honeywell	-	19	-	9	2	30
IBM	-	20	4	16	-	40
Intergraph	-	9	4	5	2	20
NCR	-	16	2	3	-	21
Prime	-	12	2	4	2	20
Texas Instruments	-	15	-	4	1	20

## EXHIBIT V-9

## USER RATINGS OF SERVICE ENGINEERS SELLING NEW MODELS OF EQUIPMENT

VENDORS	FAVOR STRONGLY	FAVOR MILDLY	NEUTRAL	OPPOSE MILDLY	OPPOSE STRONGLY	NUMBER OF RESPONSES
All Vendors	8	153	26	139	16	342
Autotrol	-	8	-	12	1	21
Burroughs	1	16	2	10	1	30
Computervision	1	5	2	8	3	19
DEC	3	14	1	13	-	31
Data General	-	16	1	13	-	30
Datapoint	-	15	1	3	1	20
Four Phase	1	3	3	11	2	20
Hewlett-Packard	-	8	1	10	1	20
Honeywell	-	14	1	13	2	30
IBM	-	15	5	20	-	40
Intergraph	-	8	4	6	2	20
NCR	-	16	2	3	-	21
Prime	-	6	3	9	2	20
Texas Instruments	-	2	9	8	1	20

## EXHIBIT V-10

## USER RATINGS OF SERVICE ENGINEERS SELLING UPGRADES

VENDORS	FAVOR STRONGLY	FAVOR MILDLY	NEUTRAL	OPPOSE MILDLY	OPPOSE STRONGLY	NUMBER OF RESPONSES
All Vendors	13	193	27	93	16	342
Autotrol	-	10	-	10	1	21
Burroughs	2	17	3	7	1	30
Computervision	1	6	1	8	3	19
DEC	5	18	1	7	-	31
Data General	-	20	2	8	-	30
Datapoint	-	15	1	3	1	20
Four Phase	1	6	3	8	2	20
Hewlett-Packard	2	10	-	7	1	20
Honeywell	-	19	1	8	2	30
IBM	1	20	6	13	-	40
Intergraph	-	8	4	6	2	20
NCR	-	19	2	-	-	21
Prime	-	11	3	4	2	20
Texas Instruments	1	14	0	4	1	20

## EXHIBIT V-11

## USER RATINGS OF SERVICE ENGINEERS SELLING SOFTWARE PACKAGES

VENDORS	FAVOR STRONGLY	FAVOR MILDLY	NEUTRAL	OPPOSE MILDLY	OPPOSE STRONGLY	NUMBER OF RESPONSES
All Vendors	3	101	33	180	25	342
Autotrol	-	6	-	14	1	21
Burroughs	-	7	4	16	3	30
Computervision	-	6	1	9	3	19
DEC	1	11	3	15	1	31
Data General	-	5	3	22	-	30
Datapoint	-	10	4	5	1	20
Four Phase	-	4	3	11	2	20
Hewlett-Packard	-	6	2	11	1	20
Honeywell	-	9	-	17	4	30
IBM	-	13	5	22	-	40
Intergraph	1	3	4	10	2	20
NCR	1	10	2	6	2	21
Prime	-	6	2	10	2	20
Texas Instruments	-	5	-	12	3	20

- The marketing of maintenance contracts, upgrades, and add-ons should be tried for a considerable period of time before proceeding further.

#### **D. CONTRACT ADMINISTRATION**

- Individual vendor's results are variable, as shown in Exhibits V-12 through V-15. Contract administration issues for the industry overall are listed from favorable to negative.
  - Variable shift coverage.
  - Automatic renewal.
  - Long-term contracts over one year.
  - Standardized forms.
  - Annual invoicing.
- Users want the option of negotiating maintenance contracts. This could prove a challenge to field service when they assume maintenance contract marketing responsibility.
- Users favor long-term contracts. Knowing fixed cost over a long period of time allows for easier and more accurate planning.
- Automatic renewal is also favored by most users. From the vendors' stand-point price changes, terms and conditions, and other factors can make automatic renewal difficult to administer.

**EXHIBIT V-12**  
**USER RATINGS OF VARIABLE SHIFT COVERAGE**

VENDORS	FAVOR	NEUTRAL	OPPOSE	NUMBER OF RESPONSES
All Vendors	215	67	60	342
Autotrol	17	1	3	21
Burroughs	18	5	7	30
Computervision	12	3	4	19
DEC	15	8	8	31
Data General	19	5	6	30
Datapoint	11	5	4	20
Four Phase	13	5	2	20
Hewlett-Packard	13	4	3	20
Honeywell	21	6	3	30
IBM	27	6	7	40
Intergraph	14	4	2	20
NCR	12	5	4	21
Prime	11	8	1	20
Texas Instruments	12	2	6	20

## EXHIBIT V-13

## USER RATINGS OF AUTOMATIC RENEWAL OF CONTRACTS

VENDORS	FAVOR	NEUTRAL	OPPOSE	NUMBER OF RESPONSES
All Vendors	193	28	121	342
Autotrol	14	2	5	21
Burroughs	14	2	14	30
Computervision	9	1	9	19
DEC	21	2	8	31
Data General	20	1	9	30
Datapoint	15	-	5	20
Four Phase	10	3	7	20
Hewlett-Packard	12	1	7	20
Honeywell	15	4	11	30
IBM	19	1	20	40
Intergraph	10	5	5	20
NCR	14	3	4	21
Prime	8	2	10	20
Texas Instruments	12	1	7	20

EXHIBIT V-14

USER RATINGS OF LONG-TERM CONTRACTS

VENDORS	FAVOR	NEUTRAL	OPPOSE	NUMBER OF RESPONSES
All Vendors	160	36	146	342
Autotrol	7	2	12	21
Burroughs	8	3	19	30
Computervision	11	1	7	19
DEC	13	2	16	31
Data General	16	2	12	30
Datapoint	11	3	6	20
Four Phase	12	4	4	20
Hewlett-Packard	8	2	10	20
Honeywell	17	2	11	30
IBM	22	3	15	40
Intergraph	8	4	8	20
NCR	10	4	7	21
Prime	10	3	7	20
Texas Instruments	7	1	12	20

**EXHIBIT V-15**  
**USER RATINGS OF STANDARDIZED FORMS**  
**VERSUS NEGOTIATED CONTRACTS**

VENDORS	FAVOR	NEUTRAL	OPPOSE	NUMBER OF RESPONSES
All Vendors	128	63	151	342
Autotrol	6	3	12	21
Burroughs	11	4	15	30
Computervision	6	3	10	19
DEC	17	5	9	31
Data General	11	9	10	30
Datapoint	9	5	6	20
Four Phase	6	7	7	20
Hewlett-Packard	10	1	9	20
Honeywell	7	6	17	30
IBM	19	3	18	40
Intergraph	7	5	8	20
NCR	6	6	9	21
Prime	7	3	10	20
Texas Instruments	6	3	11	20

## E. INVOICING

- As shown in Exhibit V-16, users strongly oppose annual invoicing. There may be several reasons for this.
  - Loss of the ability to withhold payment as leverage against poor service.
  - User budget considerations.
  - Loss of funds that are set aside for maintenance, which would otherwise be prepaid.
- Discounts for annual prepaid maintenance might induce more users to participate.
- The resolution of invoicing disputes varies greatly between vendors. The results shown in Exhibit V-17 are fairly consistent with user responses throughout this survey.
- Field service managers should be responsible for resolving these disputes. Field service managers are normally closer to the facts than others within the vendor organization.

## F. DISPATCHING AND ESCALATION PROCEDURE

- As shown in Exhibit V-18, centralized control over the dispatching of trouble calls appears to be producing good results.
  - Users are generally satisfied with dispatching procedures.

## EXHIBIT V-16

## ATTITUDES OF USERS TOWARD ANNUAL INVOICING

VENDORS	FAVOR	NEUTRAL	OPPOSE	NUMBER OF RESPONSES
All Vendors	91	44	207	342
Autotrol	4	3	14	21
Burroughs	13	2	15	30
Computervision	6	2	11	19
DEC	10	2	19	31
Data General	7	5	18	30
Datapoint	8	2	10	20
Four Phase	4	5	11	20
Hewlett-Packard	3	2	15	20
Honeywell	9	3	18	30
IBM	9	5	26	40
Intergraph	4	3	13	20
NCR	6	4	11	21
Prime	3	4	13	20
Texas Instruments	5	2	13	20

EXHIBIT V-17

USER RATINGS OF THE  
RESOLUTION OF INVOICING DISPUTES

VENDORS	RATINGS (1-10)				NUMBER OF RESPONSES
	MEAN	STANDARD DEVIATION	MEDIAN	MODE	
All Vendors	6.93	2.58	8.0	8.0	270
Autotrol	6.42	2.42	7.0	8.0	21
Burroughs	6.42	2.34	6.5	5.0	24
Computervision	6.73	2.25	8.0	8.0	15
DEC	8.11	2.02	9.0	10.0	18
Data General	7.10	3.24	8.0	10.0	19
Datapoint	5.00	2.88	4.0	3.0	14
Four Phase	5.92	3.04	7.0	7.0	13
Hewlett-Packard	6.81	2.01	7.0	7.0	16
Honeywell	6.15	2.85	6.5	8.0	26
IBM	7.93	1.77	8.0	8.0	32
Intergraph	8.05	1.73	8.0	8.0	20
NCR	7.30	2.40	8.0	8.0	20
Prime	7.88	2.73	9.0	10.0	16
Texas Instruments	6.13	3.18	7.0	7.0	16

## EXHIBIT V-18

## USER ATTITUDES TOWARD DISPATCHING TROUBLE CALLS

VENDORS	RATINGS (1-10)				NUMBER OF RESPONSES
	MEAN	STANDARD DEVIATION	MEDIAN	MODE	
All Vendors	7.85	1.85	8.0	8.0	340
Autotrol	6.45	1.64	6.5	5.0	20
Burroughs	7.57	2.19	8.0	9.0	30
Computervision	8.32	1.60	9.0	8.0	19
DEC	8.26	1.71	9.0	9.0	31
Data General	8.60	1.28	9.0	9.0	30
Datapoint	8.35	1.03	8.0	8.0	20
Four Phase	7.75	1.68	7.5	7.0	20
Hewlett-Packard	7.65	1.39	8.0	7.0	20
Honeywell	6.93	2.13	7.0	8.0	30
IBM	8.43	1.69	9.0	10.0	40
Intergraph	7.75	2.02	8.0	8.0	20
NCR	7.48	1.50	8.0	8.0	21
Prime	8.30	1.03	8.0	8.0	20
Texas Instruments	7.47	2.55	8.0	9.0	19

- Most user ratings are tightly grouped around a median of 8.0 and a mean of 7.85.
- Autotrol and Honeywell users present the most notable low-side deviations, but their scores are not significantly below the norm.
- Exhibit V-19 shows that users rate their supplies fairly evenly with respect to escalation procedures that are put into effect after extended downtime.

#### G. FREQUENCY OF VENDOR/USER CONTACT

- Exhibit V-20 dramatically displays the fact that users are not impressed by the vendors' initiative with respect to improving user operations. While there is no contractual obligation on the part of vendors to take the initiative, opportunities abound.
- In an industry whose future success is in providing users with better solutions to their problems, vendor communications are crucial. A user should feel a sense of concern by vendors.
- In general, services-management communications are satisfactory to the user. However, user meetings, seminars, and training could be expanded to create a general feeling of vendor concern for the user.

## EXHIBIT V-19

## USER RATINGS OF THE ESCALATION OF EXTENDED DOWNTIME

VENDORS	RATINGS (1-10)				NUMBER OF RESPONSES
	MEAN	STANDARD DEVIATION	MEDIAN	MODE	
All Vendors	7.47	2.03	8.0	8.0	298
Autotrol	6.70	1.92	7.0	7.0	20
Burroughs	7.00	2.45	8.0	8.0	25
Computervision	7.35	1.93	8.0	5.0	17
DEC	7.48	2.32	8.0	7.0	21
Data General	7.50	2.19	8.0	9.0	24
Datapoint	7.28	2.32	8.0	8.0	18
Four Phase	7.39	2.57	8.0	8.0	18
Hewlett-Packard	7.68	1.20	7.0	7.0	19
Honeywell	7.93	1.41	8.0	8.0	28
IBM	8.38	1.81	5.0	10.0	34
Intergraph	7.55	2.06	8.0	8.0	20
NCR	7.37	1.54	7.0	7.0	19
Prime	6.84	2.59	8.0	8.0	19
Texas Instruments	7.38	1.54	8.0	8.0	16

EXHIBIT V-20

VENDORS TAKING THE INITIATIVE  
TO IMPROVE USER OPERATIONS

VENDORS	RATINGS (1-10)				NUMBER OF RESPONSES
	MEAN	STANDARD DEVIATION	MEDIAN	MODE	
All Vendors	5.74	2.32	6.0	5.0	314
Autotrol	4.71	2.00	5.0	3.0	21
Burroughs	5.39	2.77	5.0	2.0	28
Computervision	5.58	2.19	5.0	5.0	19
DEC	5.93	2.45	6.0	5.0	30
Data General	6.28	2.28	7.0	7.0	25
Datapoint	6.29	1.90	7.0	7.0	17
Four Phase	5.00	2.74	4.5	4.0	18
Hewlett-Packard	5.60	2.03	5.0	4.0	20
Honeywell	5.89	2.21	6.0	8.0	27
IBM	6.54	2.19	7.0	7.0	35
Intergraph	5.37	2.29	5.0	5.0	19
NCR	6.35	2.52	6.5	5.0	20
Prime	5.94	1.95	6.0	5.0	18
Texas Instruments	4.58	2.42	5.0	5.0	17

VI FIELD SERVICE PRICING



## VI FIELD SERVICE PRICING

- One of the areas of significantly increased management concern is field service pricing.

### A. USER RESISTANCE TO PRICE INCREASES IS INCREASING

- "Cost of ownership" is becoming a common term to the small-system community. When decisions are made on computer systems, maintenance charges and software costs can become threshold items. Factors that are included in cost of ownership are:
  - Software cost.
  - Software services.
  - Maintenance charges.
  - Environmental requirements.
  - Power consumption.
  - Product life.

- Residual value of the product.
- Upgradability.
- Education.
- Documentation.
- Supplies.
- Employee expense.
- Communication expense.
- Product cost.

- Most field service executives are familiar by now with the effects of different rates of improvement in products' price/performance, and with the slower rate of improvement in maintenance charges.
  - For several years now, product performance per dollar has improved at an average compounded rate of 20%.
  - Maintenance rates, which improve only with new products and which actually increase for discounted older products, have become much more visible and, consequently, a threshold factor in comparing the cost of owning competitor's equipment.
- Vendors have become creative in the manner in which services are offered. Some methods offered are:
  - Scheduled maintenance.
  - Volume discount.

- Service centers.
- Modular system design.
- Response time discounts.
- Remote location mail-in.
- Support centers.

- Users in general favor on-site maintenance and use negotiations with sales to keep costs in line. Customized maintenance plans for users are common in today's market. There is a point of diminishing returns, however, where the vendors' costs for meeting these commitments cut into their profit margins.

## B. SERVICE-RELATED PRICE ELASTICITY

- Price elasticity is one of those ambiguous terms from economic theory; it refers to the slope of demand curves.
  - The more elastic the demand for services, the more likely that an increase in maintenance prices will result in users selecting alternative vendors for services.
  - Service demand curves are rarely linear; therefore, elasticity will change throughout a reasonable range of price-change considerations.
  - A 10% increase in maintenance prices may lose 2% of a vendor's customers, while a 20% increase may lose 10% of the same customer base. In this example, demand is significantly more elastic in the range of 10% to 20% than it is from 0-10%.

- Major factors affecting the relative elasticity of demand for maintenance services versus price include:
  - Convenient alternative sources of equivalent maintenance.
  - Alternatives to maintenance itself, e.g., more reliable equipment requiring less maintenance.
  - Visibility of maintenance cost (the ratio of maintenance costs to the total cost of ownership of the equipment type).
  - Tolerance for downtime on the equipment (total cost of idle resources affected).
- Elasticity can be modified or marked by other factors, for example:
  - Unbundled maintenance effectively allows users to purchase required services and to reject luxury items that users consider too expensive.
  - Vendors can mask increases in prices by introducing one or more additional benefits, such as remote diagnostics, which may be a cost reduction or vendor productivity improvement.

### C. SERVICE PERFORMANCE GUARANTEES

- The practice of selling performance guarantees has a questionable future, in light of users' general satisfaction level with hardware maintenance and vendor responsiveness.

- Measurement standards for performance that is acceptable to both user and vendor would be difficult to establish. Disagreements on performance measurements would create additional customer problems.
- Judging from the survey, users are most interested in performance guarantees for servicing software. Guarantees would create greater pressure on the software support organizations to resolve reported problems.
- Users would not pay a significant premium for performance guarantees.

#### D. DELIVERY-MODE-RELATED DISCOUNTS

- Today there is a trend within the service industry to offer several maintenance plans, with discounts for volume or relaxation of the response time criteria.
  - With large volumes of equipment in one location, travel expense is reduced.
  - Travel costs can also be reduced by offering scheduled maintenance.
  - Vendor involvement, through remote diagnostics and the replacement of components or modules, reduces the manpower required and thus the wage expense.
  - Depot maintenance (a system whereby components and units can be mailed in or even delivered for repair) reduces costs drastically.
- Most new service methods reduce the vendors' exposure to their users. This reduction could seriously affect future sales opportunities.

- As taken from Exhibits VI-1 through VI-6, the following is a prioritized list of how users rate different discounted maintenance methods, with most desirable listed first:
  - On-site response (hardware and software).
  - Customer involvement using remote diagnostics.
  - Customer involvement using support centers.
  - Customer replacement of components and modules.
  - Delivering modules to repair centers.
  - On-site maintenance during critical periods.
- One consideration in determining the practicality of these plans is the administrative costs and resources that are required to implement them.
- One must carefully weigh the impact on user productivity that is caused by user involvement in the diagnosis of problems. This is a concern expressed by some users, but is not always considered by vendors.
- Exhibits VI-1 through VI-7 show that the establishment of new service methods that are unique to small systems is going to meet opposition. As service expenses continue to rise, high cost of ownership will force users to accept new methods of maintaining their equipment. The key will be to offer a wide variety of maintenance plans.
- Users object most to the delivery of modules to a service center. This requirement may be effective in the terminal or peripheral sector, but should be discouraged in the small-systems sector.

**EXHIBIT VI-1**  
**DEMAND FOR ON-SITE RESPONSES TO CALLS**

VENDORS	MEAN RATINGS (1-10)		NUMBER OF RESPONSES
	HARDWARE	SOFTWARE	
All Vendors	8.4	8.1	332
Autotrol	8.3	8.2	20
Burroughs	7.4	7.5	30
Computervision	8.7	8.4	19
DEC	8.6	8.1	30
Data General	8.0	7.9	30
Datapoint	7.5	7.5	20
Four Phase	8.4	7.8	17
Hewlett-Packard	8.6	8.2	20
Honeywell	7.9	7.6	30
IBM	8.8	8.6	40
Intergraph	9.3	9.0	20
NCR	8.6	8.2	21
Prime	8.7	8.6	20
Texas Instruments	8.5	7.8	15

## EXHIBIT VI-2

## DEMAND FOR USER INVOLVEMENT WITH SUPPORT CENTERS

VENDORS	MEAN RATINGS (1-10)		NUMBER OF RESPONSES
	HARDWARE	SOFTWARE	
All Vendors	5.5	5.6	332
Autotrol	3.7	3.9	20
Burroughs	6.7	7.2	30
Computervision	6.1	5.9	19
DEC	5.9	6.1	30
Data General	7.1	7.0	29
Datapoint	5.7	5.4	20
Four Phase	5.2	5.7	17
Hewlett-Packard	5.4	6.0	20
Honeywell	5.6	5.9	30
IBM	4.8	5.0	39
Intergraph	3.8	3.8	20
NCR	5.0	5.1	20
Prime	5.1	4.6	20
Texas Instruments	6.5	6.5	18

## EXHIBIT VI-3

## DEMAND FOR USER INVOLVEMENT IN USING REMOTE DIAGNOSTICS

VENDORS	MEAN RATINGS (1-10)		NUMBER OF RESPONSES
	HARDWARE	SOFTWARE	
All Vendors	6.3	6.6	306
Autotrol	6.3	7.0	20
Burroughs	6.2	6.8	29
Computervision	6.2	6.6	15
DEC	6.7	7.0	28
Data General	7.5	7.7	28
Datapoint	6.3	6.5	16
Four Phase	5.6	6.2	15
Hewlett-Packard	6.2	7.0	19
Honeywell	6.3	7.0	25
IBM	6.3	6.5	39
Intergraph	6.2	6.2	20
NCR	6.0	6.4	17
Prime	6.4	5.6	19
Texas Instruments	6.2	N/A	16

**EXHIBIT VI-4**  
**DEMAND FOR USER INVOLVEMENT IN**  
**REPLACING COMPONENTS AND PATCHING SOFTWARE**

VENDORS	MEAN RATINGS (1-10)		NUMBER OF RESPONSES
	HARDWARE	SOFTWARE	
All Vendors	5.1	5.3	332
Autotrol	4.4	5.0	20
Burroughs	4.9	7.1	30
Computervision	5.9	5.0	19
DEC	5.2	5.9	30
Data General	6.3	7.2	29
Datapoint	5.0	5.7	19
Four Phase	7.0	4.6	17
Hewlett-Packard	3.7	3.9	20
Honeywell	4.5	5.3	30
IBM	4.3	4.0	39
Intergraph	3.6	4.5	20
NCR	5.6	5.8	21
Prime	7.0	4.5	20
Texas Instruments	6.1	6.5	18

**EXHIBIT VI-5**  
**DEMAND FOR PROGRAMS WHEREBY**  
**USERS DELIVER MODULES TO REPAIR CENTERS**

VENDORS	MEAN RATINGS (1-10)		NUMBER OF RESPONSES
	HARDWARE	SOFTWARE	
All Vendors	4.0	3.9	326
Autotrol	3.7	3.7	20
Burroughs	3.8	4.5	29
Computervision	4.0	4.0	19
DEC	4.3	4.3	30
Data General	4.9	4.6	27
Datapoint	4.2	4.1	19
Four Phase	3.6	3.6	17
Hewlett-Packard	3.5	3.2	20
Honeywell	4.5	4.2	29
IBM	3.8	3.7	39
Intergraph	2.1	2.1	20
NCR	4.2	4.5	21
Prime	3.4	3.4	19
Texas Instruments	5.2	5.3	17

## EXHIBIT VI-6

USERS' RATINGS OF DEMAND FOR ON-SITE STANDBY OF  
SERVICE ENGINEERING DURING CRITICAL PERIODS

VENDORS	MEAN RATINGS (1-10)		NUMBER OF RESPONSES
	HARDWARE	SOFTWARE	
All Vendors	4.0	4.0	305
Autotrol	4.8	4.8	19
Burroughs	3.5	3.5	28
Computervision	4.1	4.1	17
DEC	2.8	2.2	29
Data General	3.7	4.0	16
Datapoint	4.4	4.3	19
Four Phase	3.4	3.4	17
Hewlett-Packard	4.5	4.5	20
Honeywell	4.7	4.7	29
IBM	4.2	4.2	38
Intergraph	4.8	4.8	20
NCR	4.2	4.3	20
Prime	4.3	4.3	16
Texas Instruments	3.0	3.1	17

EXHIBIT VI-7

USER ATTITUDES TOWARD UNBUNDLING  
OF MAINTENANCE REQUIREMENTS

VENDOR	HARDWARE			SOFTWARE		
	FAVOR	NEUTRAL	OPPOSE	FAVOR	NEUTRAL	OPPOSE
All Vendors	202	44	95	164	43	65
Autotrol	11	1	9	11	1	9
Burroughs	25	1	4	25	2	3
Computervision	13	3	3	12	3	4
DEC	18	4	9	17	6	8
Data General	18	2	10	18	6	6
Datapoint	8	2	10	7	3	10
Four Phase	12	6	2	12	6	2
Hewlett-Packard	10	1	9	11	—	9
Honeywell	11	4	15	—	—	—
IBM	22	7	11	—	—	—
Intergraph	11	3	6	10	4	6
NCR	14	4	3	13	5	3
Prime	13	3	3	12	4	4
Texas Instruments	16	3	1	16	3	1

- One concern expressed by users is the difficulty of maintaining products at the latest engineering level without traditional-type maintenance.

#### E. UNBUNDLING (HARDWARE AND SOFTWARE)

- Users, according to survey Exhibit VI-7, heavily favor the unbundling of hardware and software maintenance requirements. Only Honeywell users significantly opposed it.
- Unbundling may produce increased competition from third-party maintenance companies. Selling maintenance will become a full-time position for some field service managers.
- As a result of unbundling, field services will become more autonomous in many vendor organizations.

## VII STRATEGY RECOMMENDATIONS



## VII STRATEGY RECOMMENDATIONS

### A. USER REQUIREMENT FORECASTS AND TIMING

- The increasing use of telecommunications over the next several years will present new challenges for both users and vendors. New transmission methods, such as Ethernet, will require different maintenance strategies and plans.
- If present service policies prevail, the cabling or media within a building are the user's responsibility. If this policy continues, the user will be forced to develop in-house maintenance capabilities or rely on third-party services.
- Systems of different size and manufactured by different vendors will be communicating with each other and this will force protocol standardization. Vendors that fail to submit to this standardization will lose market share.
- The use of workstations, facsimile equipment, new input devices, and manufacturing systems will all increase dependence on computer systems. This will create additional pressure on field service personnel to keep downtime to a minimum.
- Along with continued reductions in hardware cost, users will expect redundant or backup circuitry in most new systems. Scheduled maintenance will become commonplace and error-reporting equipment will be used as a guide to prevention.

- Equipment in remote locations will increase. Vendors should decide to either support remote areas or use authorized agents.
- Users will require standardization of maintenance plans, performance measurements, software maintenance agreements, hardware maintenance agreements, protocols, communication methods, and diagnostic techniques.
- Service organizations must learn to cooperate with each other, or users will move toward alternatives.
- Users will require a clear definition of supported products. Vendors usually have a definite understanding of what is supported. Users, especially those new to the computer industry, are often confused as to what is covered under maintenance agreements.
- Users will demand more effective and responsive software maintenance. Vendors must invest in the future by training field service personnel in software support.
- Increased pressure for clear and complete documentation will force vendors to review their product development methods. Supporting the product will become equal or greater in importance to building the product.
- In order to properly support users, vendors will assign account representatives other than salesmen to handle all after-sales service. Field service could fulfill this function.
- Supplies sales is an opportunity for all vendors to increase revenues and provide users with needed services. Although users generally did not want to deal with field engineers when purchasing supplies, field engineering services can be used. Centralized dispatching can handle order-taking and field engineering logistics can handle shipment. Several large-system vendors hire

salespeople who report to field service and are dedicated to selling supplies. Field engineering should have the responsibility for managing this service.

## B. SERVICE OPPORTUNITIES, 1983-1988

- According to recent INPUT industry surveys, over 90% of field service organizations are now measured as profit centers.
  - Productivity becomes a key issue on the expense-control side of the ledger.
  - Leverage of required resources through the generation of additional revenues becomes the second key issue.
- A review of the survey indicates several opportunity areas for vendors.
  - Improved software support.
  - Documentation.
  - Supplies sales.
  - Training.
  - Add-ons and upgrades.
  - Consulting services.
- As discussed earlier, taking the initiative to improve customer operations improves vendor images and uncovers many opportunities to generate additional revenues.

- Third-party maintenance companies have been operating successfully for years on the premise that a marketing perspective is the best orientation for field service management.
- Third-party suppliers of support to the after market (and, through subcontracts, to vendors) have proved that there are profit margins available through ancillary services, such as:
  - Training.
  - Documentation.
  - Depot repair.
  - Specialist support.
  - Consulting.
- System management contracts will become more attractive to users over the next several years. Today the need is not yet perceived, but as the industry evolves it will become more difficult to determine which of several products is failing.
- Vendors reluctant to provide service to networks and media will find themselves losing out to third-party maintenance organizations.
- Software maintenance must become more responsive and effective. Using field service personnel should be considered. A commitment for training and support should be part of that consideration, but it cannot be accomplished overnight. The longer a decision is delayed, the more difficult this strategy becomes.

- Firmware should be considered a hardware responsibility. The groups that actually fix the code at the vendor location may be part of a development team, but field service should handle the priority-setting, distribution, and user communications. This would help simplify procedures from the user's standpoint.
- Documentation must be written to the user's requirements. In most small-system installations, the level of system expertise is low.
- Field engineers are generally closer to operators and users. Their participation in creating user documentation will be invaluable.
- Several service organizations are implementing new service methods: support centers, mail-in or delivery of modules to service centers, remote diagnostics, and scheduled maintenance.
  - All these services reduce maintenance costs to the user.
  - They also reduce the personal contact with the user.
  - The survey results show that users are reluctant to use these new services.
  - Costs are important, however, and users will learn to accept these methods.
  - What is needed is a plan to provide the personal service that is no longer available to the users.
- In the past, field engineers made what was called "goodwill" calls.
  - This should be formalized into a scheduled program.

- This way, future sales opportunities, as well as operational problems, could be handled professionally.
- Increased revenues would pay for this program.

### C. REVENUE SOURCE PROJECTIONS

- As a percentage of the installed base, standard maintenance contract revenues will decline in the hardware area.
- Products will be more modularly constructed and module exchange will become accepted.
- Vendors will supply consultant services to users who are under contract.
  - Several independent consultants have become very successful.
  - The use of qualified field personnel will produce significant revenues.
- Significant revenues will be produced by maintenance management contracts that cover both telecommunications equipment and service.
- Pickup and delivery service for failing modules will become a significant portion of the business. Also, the sales of initial sparing of modules will increase service revenues.
- In many cases upgrades and add-on sales are not realized because salespeople are concentrating on new business.
  - Users seem generally agreeable to dealing with field engineers in a sales capacity.

- The sale of both upgrades and add-ons by field service could be easily accomplished; this would create a significant impact on overall revenues.
- Software maintenance contracts may be difficult to sell to inexperienced users.
  - Hardware failures are understandable; software failures are considered design problems.
  - It may be easier to sell a contract that is combined with team system maintenance.
- Additional revenues could be realized through specialized maintenance services. Off-hours PM, variable shift coverage, and system upgrades are but a few sources.

#### **D. SMALL-SYSTEM USERS RECOMMENDATIONS**

- The small-system user has needs that are similar to those found in the large-system sector; therefore, future evolution can be partly predicted. Following a trend set by large-system vendors, small-system vendors can with greater productivity use field engineers to provide an even wider variety of service.
- Small-system vendors can improve software maintenance communication and response by setting problem-resolution deadlines, getting field service involved, and setting response time goals.
  - Software response service will become more critical as systems become more complex.

- Software time should be the same as hardware response time.
  - To lessen user involvement, field service should be trained in the use of remote diagnostics for software support.
- To prevent user confusion, operating systems should be installed by field engineering.
- Small-system vendors should offer maintenance management contracts and a wide variety of maintenance plans that have provisions for servicing communication media.
  - Provide variable-shift maintenance, thereby responding to the plan that is most frequently requested.
  - Combine hardware and software contracts.
  - Unbundle hardware and software maintenance requirements.
  - Have field service responsible for the marketing of all maintenance contracts.
  - Use third-party maintenance or use agents in remote locations that are not profitable for the vendor.
- Create simpler documentation that defines the user as the main audience.
  - Field service and user personnel should review vendor documentation prior to final printing.
  - Distribute publications listing the documentation that is available to users.

- Deliver products that have one complete set of required documentation.
- Adopt a total after-sales support policy.
  - The vendors with the best service images assume the role of guardian of the users' interests from the moment they sign for new equipment.
  - The attitude of after-market support is a positive attitude which goes very far toward reducing the traditional negative connotations of maintenance.
  - Most users are good business people who appreciate the image-building efforts of vendors and know that the payoff is expected at reorder time or when competition comes calling.
  - Credibility as guardians of users' interests also pays off when revisions or innovations are required.
- The evolution of control in the marketplace is toward the division of responsibility between a generation of new accounts, and the service and protection of existing accounts.
  - Except by reputation or via occasional sales-assistance meetings, field engineering will rarely be directly involved in generating new accounts.
  - Field engineering, as it is presently organized, can either take the lead in the after-market function or become a subordinate department.
  - INPUT believes that most field service organizations have the potential to take the leadership role.



## APPENDIX A: QUESTIONNAIRE



### Interview Profile (R/A check proper row items)

## \* VENDOR \* PRODUCT

IBM        Sys 32        Sys 34        8100        49XX

Burroughs \_\_\_\_\_ B 800 \_\_\_\_\_ B 900 \_\_\_\_\_ B-93 \_\_\_\_\_

Honeywell DPS6 Series 60

DEC        300 series        500 series        PDP11/70

## Data General      CS/50      Eclipse      Nova

Hewlett-Packard HP3000

Texas Instruments 990 DS 990

NCR 8100 8200 I-9000

Four Phase IV/40 IV/50

Datapoint 6600 8800

Prime      100 series      200 series      300      400      500

Computervision Designer

Autotrol AD /380

Intergraph IGS

\* DATA ENTRY: Enter only one vendor

\* DATA ENTRY: Enter only one vendor and one product per questionnaire.

1. On a scale of 1-10, please rate \_\_\_\_\_ (vendor)  
in the following categories:

	(1-10)
a) Service management communication	_____ (A1)
b) Hardware service engineer's communication	_____ (A2)
c) Software service engineer's communication	_____ (A3)
d) Ability to diagnose problems in hardware and to make quality repairs	_____ (A4)
e) Ability to maintain software	_____ (A5)
f) General responsiveness of the vendor organization	_____ (A6)
g) Overall service image	_____ (A7)
h) Taking the initiative to improve user operations	_____ (A8)
i) Resolution of invoicing disputes	_____ (A9)
j) Dispatching trouble calls	_____ (A10)
k) Escalation of extended downtime	_____ (A11)

Comments: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

2. How long does it normally require \_\_\_\_\_ to repair your equipment? \_\_\_\_\_ hours. (R/A, fill in vendor name.)  
 \_\_\_\_\_ (R1)

3. What is your requirement for hardware service response time? \_\_\_\_\_ hours.  
 \_\_\_\_\_ (R2)

4. What is the average time it takes \_\_\_\_\_ (vendor to) respond? \_\_\_\_\_ hours. (R/A, fill in vendor.)  
 \_\_\_\_\_ (R3)

5. The following questions relate to software maintenance response time, i.e., the time required to have software maintenance person dedicated to resolution.

	Required (hours)	Actual Average (hours)
a) Response time of software engineer when system is inoperable	_____ <small>(R4)</small>	_____ <small>(R5)</small>
b) Response time when system is significantly degraded	_____ <small>(R6)</small>	_____ <small>(R7)</small>
c) Response time when problem is circumvented with mild degradation	_____ <small>(R8)</small>	_____ <small>(R9)</small>

6. a) What overall level of availability do you require of your equipment? (Availability is defined as the ratio of scheduled usage divided by the sum of scheduled time plus downtime plus recovery time.) \_\_\_\_\_ %  
 \_\_\_\_\_ (R10)

b) What level availability are you experiencing? \_\_\_\_\_  
 \_\_\_\_\_ (R11)

7. What level of availability do you require of your equipment during your most critical periods? \_\_\_\_\_ %  
 \_\_\_\_\_ (R12)

8. a) Please rank the 3 most critical applications using your \_\_\_\_\_ equipment with 1 being most critical (R/A, fill in appropriate vendor designation in blank space).

b) On a scale of 1-10, with 10 representing critical to the survival of your business, how critical does downtime become during the following applications?

Applications	(a) Rank	(b) Rate
Order Entry/Accounts Receivable	(A12)	(A13)
Purchasing/Accounts Payable	(A14)	(A15)
General Ledger Accounting	(A16)	(A17)
Payroll	(A18)	(A19)
Materials/Inventory Controls	(A20)	(A21)
Cost Accounting	(A22)	(A23)
Engineering, Design/CAD	(A24)	(A25)
Process Control/CAM	(A26)	(A27)
PERT/CPM	(A28)	(A29)
Time Sharing	(A30)	(A31)
Reservations	(A32)	(A33)
Scientific Analysis	(A34)	(A35)
Business Modelling	(A36)	(A37)
Business Graphics	(A38)	(A39)
Transaction Control	(A40)	(A41)
Other _____	(A42)	(A43)

9. On a scale of 1-10, how important is a single source of maintenance to you? (1 = no importance, 5 = worth serious consideration, 10 = absolutely necessary) \_\_\_\_\_

(A51)

10. Do you employ third-party maintenance for any of your equipment?

Yes/No \_\_\_\_\_

(C1)

11. Have you considered third-party maintenance as a single source?

Yes/No \_\_\_\_\_

(C2)

12. Would you consider a maintenance management contract as an alternative to a single source or third-party? The management contract would provide you with a single interface to all vendors. Yes/No \_\_\_\_\_

(C3)

\* DATA ENTRY: Questions 10-12 are single character entries, either "Y," or "N," or nothing.

13. Do you have a requirement for any of the following services, and if so, what would you consider a reasonable premium to pay over the basic maintenance charge?

Service	* Yes /No	Reasonable Premium (percent)
a) Stand-by coverage during critical periods	<hr/> (C4)	<hr/> (A52) <input type="text"/>
b) Guaranteed uptime	<hr/> (C5)	<hr/> (A53) <input type="text"/>
c) Guaranteed response time	<hr/> (C6)	<hr/> (A54) <input type="text"/>
d) On-site spare parts	<hr/> (C7)	<hr/> (A55) <input type="text"/>
e) Remote diagnostics	<hr/> (C8)	<hr/> (A56) <input type="text"/>
f) Preventive maintenance and field changes during off-prime hours	<hr/> (C9)	<hr/> (A57) <input type="text"/>
g) Occasional shift coverage (versus fixed schedule)	<hr/> (C10)	<hr/> (A58) <input type="text"/>
h) Full-time, on-site service engineer	<hr/> (C11)	<hr/> (A59) <input type="text"/>
i) Guaranteed repair time (hardware)	<hr/> (C12)	<hr/> (A60) <input type="text"/>
j) Guaranteed turnaround on software fixes	<hr/> (C13)	<hr/> (A61) <input type="text"/>

\* DATA ENTRY: For "Yes/No" column see note on preceding page.

14. a) Please rate, on a scale of 1-10, your requirements for the following vendor goods and services.

b) Please rate your current level of satisfaction with the goods and services you receive from your equipment and/or maintenance vendor.

Vendor Goods and Services	Scale 1-10	
	Requirement (a)	Current Level (b)
Environmental Planning	(A62)	(A63)
Physical Site Planning	(A64)	(A65)
Consulting	(A66)	(A67)
Documentation	(A68)	(A69)
Training	(A70)	(A71)
Installation Planning	(A72)	(A73)
Hardware Maintenance	(A74)	(A75)
Software Maintenance	(A76)	(A77)
Supplies Sales	(A78)	(A79)
Add-on Sales	(A80)	(A81)
Site Audits	(A82)	(A83)
Relocation	(A84)	(A85)
De-installation	(A86)	(A87)

15) Would you favor or oppose having the field service engineer in a sales role for the following:

	Favor		Neutral	Oppose	
	Strongly	Mildly		Mildly	Strongly
Supplies	— (B1) —	— (B2) —	— (B3) —	— (B4) —	— (B5) —
Hardware features	— (B6) —	— (B7) —	— (B8) —	— (B9) —	— (B10) —
Add-on equipment	— (B11) —	— (B12) —	— (B13) —	— (B14) —	— (B15) —
New models of equipment	— (B16) —	— (B17) —	— (B18) —	— (B19) —	— (B20) —
Upgrades	— (B21) —	— (B22) —	— (B23) —	— (B24) —	— (B25) —
Software packages	— (B26) —	— (B27) —	— (B28) —	— (B29) —	— (B30) —

16. Regarding your maintenance contracts, which of the following provisions do you favor or oppose?

	Favor	Neutral	Oppose
Long-term contracts > 1 year	— (B31) —	— (B32) —	— (B33) —
Automatic renewal	— (B34) —	— (B35) —	— (B36) —
Variable shift coverage	— (B37) —	— (B38) —	— (B39) —
Standardized forms (versus negotiated contracts)	— (B40) —	— (B41) —	— (B42) —
Annual invoicing	— (B43) —	— (B44) —	— (B45) —

17. Assuming appropriate discounts or premiums as applicable, please rate the relative importance of receiving your hardware and software maintenance by the following methods: (scale 1-10)

	(1-10)	
	Hardware	Software
Traditional, on-site response to trouble calls	_____ (A89)	_____ (A90)
Your involvement in diagnosis working with support center without remote diagnostics	_____ (A91)	_____ (A92)
Your involvement in diagnosis with remote diagnostics	_____ (A93)	_____ (A94)
Your involvement replacing circuit boards, other components, or patching software	_____ (A95)	_____ (A96)
Delivering portable modules to repair centers	_____ (A97)	_____ (A98)
On-site stand-by of service personnel during critical periods.	_____ (A99)	_____ (A100)

18. Do you favor or oppose the unbundling of maintenance requirements?

	Favor	Neutral	Oppose
Hardware	_____ (B46)	_____ (B47)	_____ (B48)
Software	_____ (B49)	_____ (B50)	_____ (B51)

19. In your opinion, what changes should \_\_\_\_\_ (vendor) make to significantly improve the level of service?

20. Are the improvements needed generally throughout field service or just at \_\_\_\_\_ (vendor)?

Comments: \_\_\_\_\_

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## APPENDIX B: DATA BASE FORMAT



## APPENDIX B: DATA BASE FORMAT

### A. DATA BASE OVERVIEW

- The user requirements data base is held at INPUT on Apple computers using the CP/M operating system.
- Data entry was accomplished using Ashton-Tate's dBASE II relational data base management system. The same system was used to create the raw data printouts already delivered.
- The data base for large- and medium-system users is contained in three raw data files and one numeric file created from quantifiable raw text data.
  - LSA.SDF 52K
  - LSB.SDF 56K
  - LSC.SDF 33K
  - LSD.SDF 23K
- Original dBASE file structures are also provided for clients who wish to restore the files to the dBASE format for analysis. The dBASE structures are stored on corresponding file names appended with the ".DBF" extension:

- LSA.DBF IK
- LSB.DBF IK
- LSC.DBF IK
- LSD.DBF IK

## B. DESCRIPTION OF FILES

- Exhibits B-1 through B-4 list the field names of the four files as originally created under dBASE II.
  - These field names and parameters are contained in the four dBASE II structure files (LSA.DBF, LSB.DBF, etc.) for restoring data from the SDF format to dBASE II format.
  - Fields are easily recognizable by the corresponding question numbers and/or data cell descriptors in the questionnaire reproduced in Appendix A.
  - The listings contain additional information about the data type, maximum allowable characters in the field, and the number of decimal positions.
    - For example, in Exhibit B-1, the "Q2" field (number 18) is type "N" (numeric), is 7 characters wide (6 numerals and a decimal point), and contains 2 decimal positions.
    - A second example in Exhibit B-1 is the field "VENDOR" which contains alphanumeric characters (C) and has a maximum capacity of 20 characters (20).

## EXHIBIT B-1

## LSA. DBF

FIELD	NAME	TYPE	WIDTH	DEC
001	Cat:No	N	005	001
002	Zip	C	005	
003	Industry	C	030	
004	Area	C	003	
005	Vendor	C	020	
006	Product	C	020	
007	Q1:A	N	002	
008	Q1:B	N	002	
009	Q1:C	N	002	
010	Q1:D	N	002	
011	Q1:E	N	002	
012	Q1:F	N	002	
013	Q1:G	N	002	
014	Q1:H	N	002	
015	Q1:I	N	002	
016	Q1:J	N	002	
017	Q1:K	N	002	
018	Q2	N	007	002
019	Q3	N	007	002
020	Q4	N	007	002
021	Q5:A:REQ	N	007	002
022	Q5:A:ACT	N	007	002
023	Q5:B:REQ	N	007	002
024	Q5:B:ACT	N	007	002
025	Q5:C:REQ	N	007	002
026	Q5:C:ACT	N	007	002
027	Q6:A	N	006	002
028	Q6:B	N	006	002
029	Q7	N	006	002

EXHIBIT B-2  
LSB. DBF

FIELD	NAME	TYPE	WIDTH	DEC
001	Cat:No	N	005	001
002	Q 8:1:APP	C	031	
003	Q 8:1:RATE	N	003	
004	Q 8:2:APP	C	031	
005	Q 8:2:RATE	N	003	
006	Q 8:3:APP	C	031	
007	Q 8:3:RATE	N	003	
008	Q 9	N	003	
009	Q 10:Q 12	C	009	
010	Q 13:Y :N	C	034	
011	Q 13:A	N	005	001
012	Q 13:B	N	005	001
013	Q 13:C	N	005	001
014	Q 13:D	N	005	001
015	Q 13:E	N	005	001
016	Q 13:F	N	005	001
017	Q 13:G	N	005	001
018	Q 13:H	N	005	001
019	Q 13:I	N	005	001
020	Q 13:J	N	005	001
021	Q 17:A89	N	002	
022	Q 17:A90	N	002	
023	Q 17:A91	N	002	
024	Q 17:A92	N	002	
025	Q 17:A93	N	002	
026	Q 17:A94	N	002	
027	Q 17:A95	N	002	
028	Q 17:A96	N	002	
029	Q 17:A97	N	002	
030	Q 17:A98	N	002	
031	Q 17:A99	N	002	
032	Q 17:A100	N	002	

## EXHIBIT B-3

## LSC. DBF

FIELD	NAME	TYPE	WIDTH	DEC
001	Cat:No	N	005	001
002	Q14:A62	N	002	
003	Q14:A63	N	002	
004	Q14:A64	N	002	
005	Q14:A65	N	002	
006	Q14:A66	N	002	
007	Q14:A67	N	002	
008	Q14:A68	N	002	
009	Q14:A69	N	002	
010	Q14:A70	N	002	
011	Q14:A71	N	002	
012	Q14:A72	N	002	
013	Q14:A73	N	002	
014	Q14:A74	N	002	
015	Q14:A75	N	002	
016	Q14:A76	N	002	
017	Q14:A77	N	002	
018	Q14:A78	N	002	
019	Q14:A79	N	002	
020	Q14:A80	N	002	
021	Q14:A81	N	002	
022	Q14:A82	N	002	
023	Q14:A83	N	002	
024	Q14:A84	N	002	
025	Q14:A85	N	002	
026	Q14:A86	N	002	
027	Q14:A87	N	002	
028	Q15	C	018	
029	Q16	C	015	
030	Q18	C	006	

## EXHIBIT B-4

## LSD. DBF

FIELD	NAME	TYPE	WIDTH	DEC
001	Cat:No	N	005	001
002	C1	N	002	
003	C2	N	002	
004	C3	N	002	
005	C4	N	002	
006	C5	N	002	
007	C6	N	002	
008	C7	N	002	
009	C8	N	002	
010	C9	N	002	
011	C10	N	002	
012	C11	N	002	
013	C12	N	002	
014	C13	N	002	
015	B1	N	002	
016	B6	N	002	
017	B11	N	002	
018	B16	N	002	
019	B21	N	002	
020	B26	N	002	
021	B31	N	002	
022	B34	N	002	
023	B37	N	002	
024	B40	N	002	
025	B43	N	002	
026	B46	N	002	
027	B49	N	002	

- LSA is a raw data file containing demographic data (some of which has been removed to protect the users), vendor, product, and responses to questions 1 through 7.
- LSB is a raw data file containing responses to questions 8 through 13 and question 17. Raw data is contained in this file in the form of text for yes and no answers to certain questions; these text data are transformed later into numerical equivalents in LSD.
- LSC is a raw data file containing responses to questions 14 and 15 and question 18. As in LSB above, certain text data will be transformed into numerical equivalents in LSD as discussed below.
- LSD is a file created from certain raw text data in LSB and LSC substituting numerical ranges for responses:
  - Yes/no responses (C1-C13) are translated as follows:
    - No = -1
    - Yes = +1
    - No answer = 0
  - The text responses (check marks) to B1-B30 found in LSC become numeric data in LSD found in the related fields named B1, B6, . . . , B26 with the following translation:
    - Favor strongly = +2
    - Favor mildly = +1
    - Neutral = 0
    - Oppose mildly = -1
    - Oppose strongly = -2

- Similarly, the text responses from LSC in B31-B51 become numeric data in LSD fields B31, B34, . . . , B49 with three levels of translation:
  - Favor = +1
  - Neutral = 0
  - Oppose = -1
- Linkage of the files is accomplished with the questionnaire catalog number (CAT:NO) field which is common in all four files for each respondent to the questionnaire.
  - Gaps in catalog number sequence are normal; the files have been completely edited for linkage consistency.
  - The "CAT:NO" field contains one decimal position to allow the insertion of late responses into the proper sequence.
  - The requirement of multiple files was imposed by constraints in dBASE II and the desirability of restoring the files to a popular CP/M-based data base management system.
- The following information is included for those wishing to restore files to dBASE II format:
  - The dBASE II files will require disk space as follows:
    - LSA.DBF 74K
    - LSB.DBF 72K
    - LSC.DBF 32K
    - LSD.DBF 19K
  - Assume that a blank formatted disk is in CP/M drive C:, and the original LSA files are in drive B: and you wish to restore LSA to dBASE II format.

- Call dBASE in Drive A::
- Issue the following dBASE commands:
  - . USE B: LSA
  - . COPY TO C:LSA STRUCTURE
  - . USE C:LSA
  - . APPEND FROM B:LSA.SDF DELIMITED



## APPENDIX C: SMALL-SYSTEMS USERS INTERVIEWED



## APPENDIX C: SMALL-SYSTEMS USERS INTERVIEWED

- A&A TOOL RENTALS & SALES INC.
- A.J. LUNCH & COMPANY
- A.O. SMITH
- ABBOT LABORATORIES
- ABC MARKET CORPORATION
- ACADEMIC FINANCIAL SERVICES
- ACORN BUILDING COMPONENTS
- AERO INDUSTRIES
- AEROQUIP
- AKAI AMERICA
- ALABAMA CRIMINAL JUSTICE
- ALHAMBRA METAL PRODUCTS
- ALLAN HANCOCK COLLEGE
- ALLEN BRADLEY
- ALPERTO INC.
- AMBASSADOR INTERNATIONAL
- AMERADA HESS CORPORATION
- AMERICAN BENEFIT PLAN
- AMERICAN BRASS
- AMERICAN EDUCATORS
- AMERICAN HOSPITAL SUPPLY
- AMERICAN NATIONAL BANK
- AMERICAN PROGRESSIVE LIFE
- AMERICAN SAVINGS BANK
- AMERICAN TELECOMMUNICATIONS
- AMERON STEEL
- AMF CUNO DIVISION
- AMF SCIENTIFIC DRILLING INTERNATIONAL
- AMFAC DRUG DISTRIBUTORS
- AMFAC PLUMBING SUPPLY
- ANAHEIM AREA CREDIT UNION
- ANAHEIM MEMORIAL HOSPITAL
- ARIZONA HEART INSTITUTE
- ARKANSAS STATE DATA PLANNING
- ARMCO-METAL PRODUCTS DIVISION
- ARMORLITE LENS COMPANY

- ARVIN AUTOMOTIVE
- ASINC
- ASSOCIATION CARDILLO TRAVEL AGENCY
- ATLAS PACIFIC ENGINEERING
- ATS STELLS INC.
- AUSTIN COMPANY
- BABCOCK & WILCOX
- BADDOURS INC.
- BANKWEST MORTGAGE
- BAR-S FOODS CORPORATION
- BEECHCRAFT
- BELDEN CORPORATION
- BENDIX CORPORATION
- BERCOR INC.
- BIF
- BIRMINGHAM FABRICATING COMPANY
- BIRMINGHAM STOVE & RANGE
- BLAKE MOFFET & TOUNE
- BLI-FAUTLESS DIVISION
- BOB OLSEN INC.
- BOCES II
- BREA COMMUNITY HOSPITAL
- BRIDGE COMPUTER
- BRISTOL SAVING BANK
- BROWN BORERI TURBO
- BROWN SWISS MILK COMPANY
- BRUNSWICK CORPORATION
- BUCHANAN COMPANY OPS
- BURLINGTON NORTHERN
- BURTS BEVERAGES
- CA DEPARTMENT OF GENERAL SERVICES
- CA PUBLIC EMPLOYEE RETIREMENT
- CADILLAC MALLIABLE IRON
- CAL-CENTRAL PRESS
- CALIFORNIA DEPARTMENT OF TRANSPORTATION
- CALIFORNIA INDUSTRIAL PRO.
- CALIFORNIA DEPARTMENT OF INSURANCE
- CALIFORNIA HARDWARE
- CAMPBELL-BRUCE OIL
- CE HILLBERG & COMPANY
- CENTRAL TEXAS COLLEGE
- CHICAGO POLICE DATA SYSTEMS
- CHILDRENS HOSPITAL
- CHINO UNIFIED SCHOOL DISTRICT
- CHLORIDE SYSTEMS INC.
- CHRYSLER CORPORATION
- CITIZENS HOSPITAL
- CITY OF BOWLING GREEN
- CITY OF HIGHLANDS PARK
- CITY OF LAKEWORTH

- CITY OF MILWAUKEE
- CITY OF MONTEREY
- CITY OF PEMBROKE PINES
- CITY OF PITTSBURGH
- CITY OF SAN JOSE
- CITY OF SANTA CRUZ
- CITY OF SIMI VALLEY
- CITY OF SPARKS
- CITY OF TEMPE
- CITY OF WORCESTER
- COBBLEDICK-KIBBE GLASS COMPANY
- CODE 3 CORPORATION
- COMMUNITY SERVICES CREDIT UNION
- COMPUTER PROS.
- CON-STAN INDUSTRIES
- CONNECTICUT DEPARTMENT PUBLIC SAFETY
- CONSOLIDATED CONTROLS
- CONTEL DATA SERVICE COMPANY
- CONTINENTAL SCREW
- CONTRA COSTA PUBLIC WORKS
- CONTROL-O-MATION
- COOPERATIVE POWER ASSOCIATION
- CORNING BANK
- COTTON STATES MUTUAL INSURANCE
- COUNTY MOTOR PARTS
- CTS KNIGHTS INC.
- CUSHION CUT INC.
- CYCLOTRON CORPORATION
- DATA SERVICE CENTER
- DAVID LINDEMOTH INC.
- DAVIDSON INC.
- DAVY MCKEE
- DAYMARC CORPORATION
- DELTAFIELD CORPORATION
- DENCOM
- DER WIENERSCHNITZEL
- DEVLIEG MACHINE COMPANY
- DRAVO STEELSHIP CORPORATION
- DURALITE CORPORATION
- DYNACON SYSTEMS INC.
- E-SYSTEMS INC.
- EAGLE IRON WORKS
- EASTERN IDAHO DIESEL
- EATON CORPORATION
- EBASCO SERVICES
- ECO CHEMICAL PRODUCTS
- EDWARDS & KELCEY COMPANY
- EKTELON INC.
- EMHART INDUSTRIES
- EMMCO INSURANCE COMPANY

- ENVIRONMENTAL ELEMENTS
- ENVIRONMENTAL SCIENCES ASSOCIATION
- EUGENE WATER & ELECTRIC
- EVERITT COMPANIES
- F. D. TITUS & SON
- FARM BUREAU INSURANCE
- FASTER & KLEISER
- FEDERAL CARTRIDGE CORPORATION
- FEDERAL MOGUL CORPORATION
- FILPER CORPORATION
- FIRST FEDERAL SAVINGS
- FISHER CONTROLS
- FLACKS INC.
- FLUHE AUTOMATIC SYSTEMS
- FORD MOTOR COMPANY
- FRINGE BENEFITS
- FRITO LAY
- FRUEHAUF CORPORATION
- FW WITT COMPANY
- GARDNER MACHINE COMPANY
- GARRETT AIRESEARCH
- GARRETT TURBINE
- GASTON COUNTY DYING
- GATX LENSING CORPORATION
- GEARTRONICS CORPORATION
- GELHAUS MOTOR PARTS
- GENERAL ELECTRIC
- GENERAL RAILWAY SIGNAL
- GENERAL TELEPHONE
- GENERAL TIRE & RUBBER
- GEOMETRICS INC. - AIRBORNE
- GEORGIA PACIFIC CORPORATION
- GLOBLE ENGINEERING
- GMC PACKARD ELECTRIC
- GMC TRUCK SALES INC.
- GRAIN SYSTEMS INC.
- GREAT FALLS PUBLIC SCHOOLS
- GT SALES & MANUFACTURING
- GUARANTY NATIONAL INSURANCE
- HARRIS CORPORATION
- HAYES SEAY MATTERN & MATTERN
- HEAVY DUTY ELECTRIC
- HERFF JONES & COMPANY
- HOLLY CARBORATOR
- HONEYWELL INC.
- HOPE & ASSOCIATES
- HOUSTON LIGHT & POWER
- HUGHES AIRCRAFT
- HUMBOLT STATE UNIVERSITY
- HUNTER ENGINEERING

- IDAHO TRANSPORTATION DEPARTMENT
- IDEAL HARDWARE
- IKG INDUSTRIES
- IMLAC CORPORATION
- INFORMATICS INC.
- INGERSOL PRODUCTS
- INTERNATIONAL ENGINEERING
- INTERNATIONAL IMPORTS
- INTERNATIONAL KINGS TABLE
- INTERSTATE ELECTRONICS
- ITT-TELECOMMUNICATIONS
- J G WILEZ COMPANY
- JAYCO INC.
- JOHNS MANVILLE SALES
- KEENAN PIPE & SUPPLY
- KEN COOK INC.
- KEWANNA METAL SPEC.
- KIRNKLE VALUE
- KOHLER
- LA BOW PLAYNES COMPANY INC.
- LANDBERG ASSOCIATES
- LANG CONSTRUCTION
- LAWRENCE FURNITURE INC.
- LAWRENCE SYSTEMS INC.
- LEVOLOR LORENTZEN INC.
- LEXINGTON STANDARD
- LIAN CANDY CORPORATION
- LINBERG
- LOS ANGELES WATER TREATMENT
- LYNN MEDICAL INSTRUMENTS
- M&M/MARS
- MAC DERMID
- MAIN IRON WORKS
- MANGUM EQUIPMENT
- MARATHON ENGINEERING
- MARICOPA COUNTY
- MARY BALDWIN COLLEGE
- MATSON NAVIGATION
- MBPXL CORPORATION
- MCGRAW EDISON
- MCNALLEY PITTSBURGH
- MECHANICAL EQUIPMENT
- METAL-FAB INC.
- MICHIGAN PRODUCTS
- MIDLAND ROSS
- MILWAUKEE ROAD
- MISSISSIPPI PUBLISHERS CORPORATION
- MIZELL MEMORIAL HOSPITAL
- MJ HARDEN ASSOCIATES
- MOLL TOOL & PLASTICS

- MONIX INTERNATIONAL
- MONROEVILLE COUNTY BANK
- MONSANTO
- MONTANA DEPARTMENT OF REVENUE
- MONTGOMERY HOUSING AUTHORITY
- MONTROSE COUNTY
- MORG CONTROLS
- NATIONAL HQ CIVIL AIR PATROL
- NEVADA HIGHWAY DEPARTMENT
- NEVADA INDUSTRIAL COMMISSION
- NEVADA MOTOR VEHICLES DEPARTMENT
- NOR-CAL FORD EQUIPMENT
- NORTH COAST MERCANTILE COMPANY
- OKLAHOMA EMPLOYMENT
- OLSON TRAVELWORLD ORGANIZATION
- OSIRIS GROUP INC.
- P & O FALCO
- PABST BREWING COMPANY
- PAC FOUNDRY
- PACIFIC WOOD PRODUCTS
- PANHANDLE EASTER
- PASCOE BUILDING SYSTEMS
- PEOPLES NATURAL GAS COMPANY
- PHILLIPS PETROLEUM COMPANY
- PITNEY BOWES INC.
- PLOW TECHNOLOGY
- PRD ELECTRONICS
- PRICE CLUB
- PROGRAMMED BUSINESS SYSTEMS
- PUGET SOUND POWER
- RADIO STATION KRE
- RCA
- REYNOLDS METALS COMPANY
- RIVERSIDE COUNTY
- ROCKWEWLL INTERNATIONAL
- ROCKY MOUNTAIN COMPUTER
- RUAN TRANSPORTATION CORPORATION
- SACO DEFENSE SYSTEMS
- SACRAMENTO COUNTY
- SAFEWAY STORES
- SALT RIVER PROJECT
- SAN DIEGO GLASS & PAINT
- SAN FRANCISCO STATE UNIVERSITY
- SAN JOSE WATER WORKS
- SEQUOIA INSURANCE COMPANY
- SIEGELMAN & VAN DEREN
- SIMPSON TIMBER
- SINGER-KEARFOTT
- SLATER TOOLS GUAGES
- SOUTHERN ARKANAS UNIVERSITY

- SOUTHERN FREIGHT ASSOCIATION
- SOUTHLAND BENERACH DIST
- ST REGIS PAPER COMPANY
- STANLEY CONSULTANT
- STATE OF MICHIGAN DEPARTMENT
- STATIONERS CORPORATION
- STEIN DISTRIBUTING
- SUDCO INTERNATIONAL CORPORATION
- SULPHUR SPRINGS VALLEY
- SUPERIOR TRUCKING INC.
- SUPERLIGHT BUILDERS
- SYSTEM DEVELOPMENT CORPORATION
- TECUMICH PRODUCTS
- TEREX DIV-GMC
- TEXAS EDUCATIONAL FOUNDATION
- TOBIN SURVEY
- TRACTOR & EQUIPMENT COMPANY
- TRW NOBLESVILLE CASTING
- TYSON FOODS
- U.S. DEPARTMENT OF H.E.W.
- UCLA HOSPITAL
- UNITED SPACE BOOSTERS
- UNIVERSAL GRINDING WHEEL
- UNIVERSITY OF NEW HAVEN
- US CENTER FOR DISEASE CONTROL
- VALLY NATIONAL BANK OF ARIZONA
- VAN WOOD CHEMICAL
- VECTOR GENERAL
- VISITING NURSE SERVICES INC.
- WACO COMMUNICATIONS INC.
- WAHL CLIPPER CORPORATION
- WATER RESOURCES BOARD
- WEBER COUNTY GOVERNMENT
- WESTINGHOUSE ELECTRIC
- WILLIAMS HOME CENTERS
- WORTHINGTON PRIMPS
- WURLITZER COMPANY
- WYATT INC.
- YOUNGS, INC.
- YUILDINGS DEPARTMENT STORES





